

September 2019

Office of Shared Accountability

MONTGOMERY COUNTY PUBLIC SCHOOLS, ROCKVILLE, MARYLAND



Study of School Principals in Montgomery County Public Schools: Exploration of Factors Associated with Turnover and Attrition



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Highlights: Study of School Principals in Montgomery County Public Schools: Exploration of Factors Associated with Turnover and Attrition

Nyambura Susan Maina, PhD. and Juan Carlos Davila Valencia, M.S.

Background

The goal of this study is to: (1) provide an overview of the characteristics of 2018–2019 MCPS school principals at each school level (elementary, middle, and high school); (2) examine the factors associated with principals leaving their positions; (3) explore the turnover of school principals in the last nine years in MCPS and its relationship with specified school factors; and (4) investigate if there is a relationship among specific school factors and principal tenure (new or veteran).

This study addressed four questions:

1. What are the demographic characteristics of 2018–2019 MCPS school principals? Do these characteristics differ among schools with different levels of poverty and student demographic composition (school complexity)?
2. What is the principal attrition rate in MCPS? What principal and school characteristics are associated with the likelihood of a principal leaving the position?
3. What is the extent of principal turnover across MCPS schools? Do school factors (such as poverty, complexity, academic performance, and climate) differ between schools with three or more principals and schools with two or fewer principals in the last nine years?
4. Is veteran principal status associated with school factors, such as school climate, classroom teacher turnover, and academic performance in literacy and mathematics? Does this association vary by school complexity?

Descriptive analyses were used to summarize information on demographic characteristics, principal attrition by type of exit (retirement, promotion, transfer, or resignation/termination), and the distribution of schools by principal turnover. Further, Chi-square tests, binary logistic regression, or factorial analysis of variance procedures analyses were used to examine the relationships between principal and school characteristics.

Key findings

What are the demographic characteristics of MCPS principals during the 2018–2019 school year?

- Among the 200 principals in elementary, middle, and high schools during the 2018–2019 school year, the majority (65%) were female, 59% were White, 34% were Black or African American, and almost half of them (49%) were between 40 and 49 years of age.
- Principals were highly educated (85% held at least a master's degree), 56% were new hires in the last five years, and nearly all (96%) were recruited internally.
- A higher percentage of Black or African American principals (38% vs. 18%) were in high poverty elementary schools relative to White peers; conversely, the proportion of White principals in low poverty schools was higher (44% vs. 5%) relative to the proportion of Black or African American peers in similar schools (Figure 1).

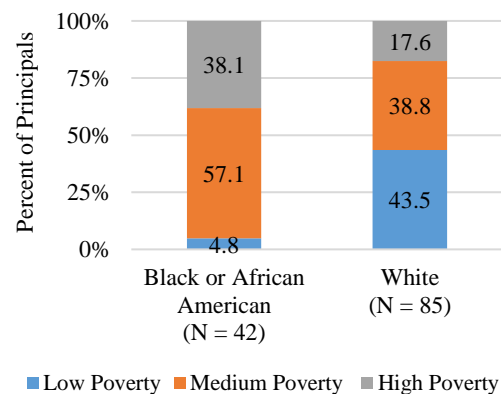


Figure 1. Relative proportions of Black or African American and White elementary school principals by race/ethnicity

- A significantly higher percentage of White principals were in low complexity elementary schools (33% vs. 7%) compared to Black or African American principals in similar schools; on the contrary, a significantly higher percentage of Black or African American principals (41% vs. 16%) were in high complexity elementary schools relative to the percentage of White peers in similar schools

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What is the principal attrition rate in MCPS since 2015?

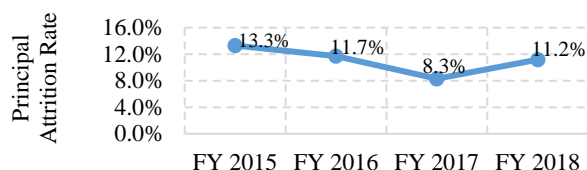


Figure 2. Principals' attrition rate in MCPS from FY 2015 to 2018

- The proportion of staff who left their principal role in FY 2018 was 11.2%, a decrease from 13.3% in 2015 (Figure 2).
- Principals in schools with a high percentage of students receiving FARMS services were more likely to leave the principal role for reasons not related to retirement.

What is the extent of principal turnover across MCPS schools?

Across all schools, the change in number of principals over nine years (from FY 2010 to 2019) per school ranged from one to five principals per school (Figure 3).

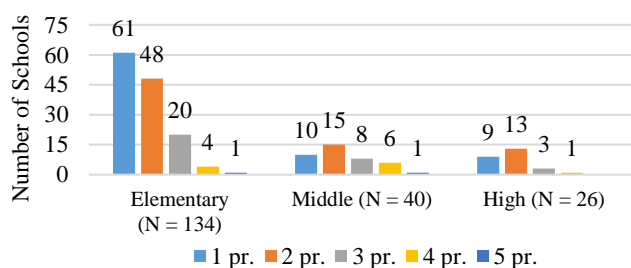


Figure 3. Distribution of Elementary, Middle, and High Schools by Principal Turnover from 2010 to 2019

Compared to schools with two or fewer principals, schools with three or more principals over the nine-year period were likely to:

- be high poverty schools (elementary only) or high complexity schools across all levels,
- have a lower percentage of students meeting at least two of the three End-of-Year Evidence of Learning (EOL) measures in literacy and mathematics, and
- have lower school climate satisfaction scores.

Is veteran principal status associated with school climate, classroom teacher turnover, and academic performance in literacy and mathematics?

- There were no significant differences in school climate, classroom teacher turnover, and academic performance (literacy and mathematics) associated with having a new or veteran principal ($p > .05$) at the elementary, middle, or high school levels. However, there was a clear association between school complexity and school climate scores, percent novice teachers, and school academic performance at the elementary, middle, and high levels, suggesting that it is the school complexity, and not the aspect of having a veteran or new principal per se, that explained the observed differences in these factors across schools.
- Having a new principal was significantly associated with higher academic performance in literacy among low complexity elementary schools; conversely having a veteran principal was associated with higher performance in literacy among high complexity elementary schools (Figure 4).

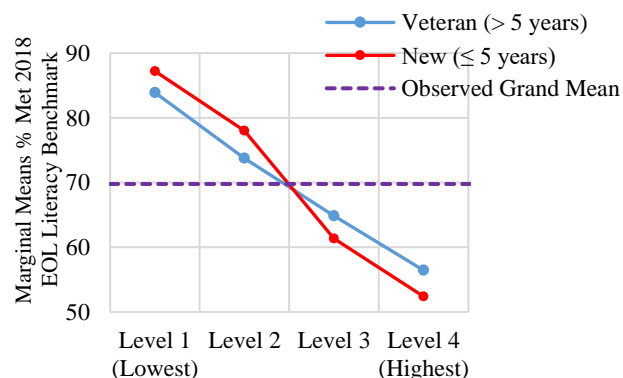


Figure 4. Percent met literacy benchmark by veteran principal status and school complexity in elementary schools

- Among high complexity middle schools led by new principals, classroom teacher turnover was significantly lower compared with rates in peer schools led by veteran principals.
- High complexity middle schools led by new principals outperformed peer schools led by veteran principals in literacy and mathematics.

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Executive Summary

At the request of the Office of the Superintendent of Schools in Montgomery County Public Schools (MCPS), the Office of Shared Accountability (OSA) conducted a study about school principals in MCPS.

The goal of this study is to: (1) provide an overview of the characteristics of 2018–2019 MCPS school principals at each school level (elementary, middle, and high school); (2) examine the factors associated with principals leaving their positions; 3) explore the turnover of school principals in the last nine years in MCPS and its relationship with specified school factors; and (4) investigate if there is a relationship among specific school factors and principal tenure (new or veteran).

This study was guided by the following questions:

1. What are the demographic characteristics of 2018–2019 MCPS school principals? Do these characteristics differ among schools with different levels of poverty and student demographic composition (school complexity)?
2. What is the principal attrition rate in MCPS? What principal and school characteristics are associated with the likelihood of a principal leaving the position?
3. What is the extent of principal turnover across MCPS schools? Do school factors (such as poverty, complexity, academic performance, and climate) differ between schools with three or more principals and schools with two or fewer principals in the last nine years?
4. Is veteran principal status associated with school factors, such as school climate, classroom teacher turnover, and academic performance in literacy and mathematics? Does this association vary by school complexity?

The samples and analytical procedures used in this study varied by research question. Data on staff serving as school principals during the 2018–2019 school year and staff in principal positions since FY 2010 were compiled from the Employee and Retiree Service Center (ERSC) databases. Other data compiled from MCPS databases included school FY 2018 and FY 2010 demographic information from Schools-at-a-Glance (SAAG), student performance (Evidence of Learning - EOL) as of FY 2018, percent of new classroom teachers per school, and 2017–2018 school climate survey responses. Descriptive analyses were used to summarize information on demographic characteristics, principal attrition by type of exit (retirement, promotion, transfers, or resignation/termination), and the distribution of schools by principal turnover. Following that, Chi-square tests and binary logistic regression analyses were used to examine, respectively, whether there were significant relationships between principal and school characteristics and how these factors were associated with leaving the principal position. Lastly, the relationships between veteran principal status (new or veteran) and school characteristics (such as poverty, complexity, academic performance, percent new classroom teachers, and school climate) were examined via factorial analysis of variance (ANOVA) as appropriate.

Summary of Key Findings

What are the demographic characteristics of current MCPS staff serving as principals? Do these characteristics differ among schools with different levels of poverty and student demographic composition (school complexity)?

- Among the 200 principals in elementary, middle, and high schools during the 2018–2019 school year (excluding special schools), 65% of them were female, 59% were White, 34% were Black or African American, and almost half of them (49%) were between 40 and 49 years of age.
- Principals in MCPS were highly educated (85% of them held a master's and 15% a doctorate degree, 56% were new hires in the last five years, and almost all of them (96%) were recruited internally.
- A higher percentage of Black or African American principals (38% vs. 18%) were in high poverty elementary schools relative to White peers; conversely, the proportion of White principals in low poverty schools was higher (44% vs. 5%) relative to the proportion of Black or African American peers in similar schools.
- A significantly higher percentage of White principals were in low complexity elementary schools (33% vs. 7%) compared to Black or African American principals in similar schools; on the contrary, a significantly higher percentage of Black or African American principals (41% vs. 16%) were in high complexity elementary schools relative to the percentage of White peers in similar schools.
- There were significantly higher proportions of Black or African American principals (41% vs. 16%) serving in the most complex elementary schools relative to their proportions in low complexity schools.

What is the principal attrition rate in MCPS since 2015? What principal and school characteristics are associated with the likelihood of a principal leaving the position?

- In FY 2018, 11.2% of MCPS staff (23 of 206 principals, including special schools) left their role as principal compared to 13.3% in FY 2015. Several reasons contributed to this decrease, such as fewer principals retiring in recent years compared to FY 2015.
- Principals who are located in schools with a high percentage of students receiving Free and Reduced Meals Services (FARMS) were more likely to leave the principal role relative to their peers located in low-poverty schools ($p < .05$).

What is the principal turnover across MCPS schools? What is the relation between school factors (such as poverty, complexity, academic performance, and climate) and the number of principals that a school had in the last nine years?

- The highest number of principals any school had during a period of nine years (from FY 2010 to 2019) was five; the minimum was one principal, reflecting no change in principals. The median was two principals across all the school levels.
- The association between principal turnover and school poverty was significant ($p < .05$) only for elementary schools; the proportion of elementary schools with high levels of poverty was greater

among schools that had more than two principals in the last nine years than in schools with only one or two principals during the same period.

- Across all levels, a higher proportion of high complexity schools had more than two principals in the last nine years compared to low complexity schools; however, none of these associations was significant ($p > .05$) in any of the school levels.
- Elementary schools with more than two principals since FY 2010 have on average a lower percentage of students meeting at least two of the three End-of-Year EOL measures in literacy and mathematics compared to elementary schools that had only one or two principals. The association between principal turnover and academic performance was statistically significant ($p < .05$) for elementary but not for middle and high schools.
- Schools with more than two principals since FY 2010 had on average a lower climate satisfaction score compared to schools that had only one or two principals. However, the association between principal turnover and climate score was not statistically significant ($p > .05$) in any of the school levels.

Is veteran principal status associated with school climate, classroom teacher turnover, and academic performance in literacy and mathematics? Does this association vary by school complexity?

- This study demonstrated that having a new or veteran principal tenure by itself was unrelated to school climate, classroom teacher turnover, and academic performance (literacy and mathematics) ($p > .05$) at the elementary, middle, or high school levels. However, there was a clear association between school complexity and school climate scores, percent novice teachers, and school academic performance at the elementary, middle, and high levels, suggesting that variation in these factors can be attributed mostly to school complexity.
- Across all levels, the school climate scores and academic performance rates among low complexity schools were significantly higher relative to high complexity schools. At the same time, the classroom teacher turnover rates among low complexity schools were lower compared to rates in high complexity schools.
- The interaction between veteran principal status and school complexity was statistically significant ($p < .05$) in the following instances:
 - *Elementary schools:* Having a new principal was associated with higher academic performance in literacy among low complexity schools whereas having a veteran principal was associated with higher performance in literacy among high complexity elementary schools.
 - *Middle schools:* Among high complexity middle schools led by new principals, the classroom teacher turnover was significantly lower relative to the teacher turnover in peer schools led by veteran principals. High complexity middle schools led by new principals outperformed peer schools led by veteran principals in literacy and mathematics.

Discussion

The findings in this study corroborated reports by other researchers that showed that schools impacted by poverty as well as schools with more students receiving special services are likely to experience the effects of principal churn at greater rates than less impacted schools are. While principal attrition rates

in MCPS since FY 2010 are within the national average of 12%, the findings also align with studies that found that high poverty schools and high complexity schools have higher principal turnover rates (School Leaders Network, 2014, Levin and Bradley, 2019).

The findings in this study do not support the premise or provide direct evidence that poor school climate or low student academic achievement are a direct result of principal turnover. Actually, this study found that school climate scores, student performance, and percent of novice classroom teachers were related more to school complexity than having a new or veteran principal. These school factors were comparable among MCPS schools of similar complexity levels regardless of principal tenure. Refocusing attention from principal turnover per se to include a concerted examination of the school settings and principal behaviors, is important. Indeed, a recent study called for investing in leadership capabilities because student achievement, teacher wellbeing, teacher instructional practices, and school organizational health are influenced directly by principal behaviors (Liebotz and Porter, 2019). Lastly, the instances of new principals doing very well in low complexity schools relative to veterans suggests that many positive changes that arise from a change in principals probably go unnoticed or unreported.

Study of School Principals in Montgomery School Public Schools: Exploration of Factors Associated with Turnover and Attrition

Nyambura Susan Maina and Juan Carlos Davila Valencia

At the request of the Office of the Superintendent of Schools in Montgomery County Public Schools (MCPS), the Office of Shared Accountability (OSA) conducted a study about school principal turnover and attrition in MCPS. Another study similarly investigated classroom teacher attrition and mobility in MCPS (Davila Valencia, Wade, Cooper-Martin, 2019). The focus of this study is to understand the issue of turnover among staff who hold principal positions in MCPS. A secondary focus is to examine how turnover in MCPS is related to specific factors identified in research as determinants and/or consequences of principal turnover.

Rationale/Need for Study

In general, principal turnover broadly includes moves or transfers to other schools, other positions, as well as exits from the school system altogether. Principals play an important role in determining school effectiveness, developing organizational capacity, and improving student learning (Rangel, 2018). Although MCPS statistical profiles provide yearly updates on principal turnover rates, the relationships between principal turnover and school factors, such as school climate, classroom teacher turnover, and student performance, have not been explored to date in MCPS. It is also unclear as to how the situation in MCPS mirrors or differs from other districts in this regard. Most of the available research on principal retention has focused primarily on identifying those factors associated with principal turnover or the impact of turnover on student achievement. However, these studies are of limited scope when it comes to explaining the extent to which different school and principal characteristics are related to principal departures, or simply whether the departure of the principal was beneficial or disruptive to the school.

As such, this study explores principal turnover from two perspectives: (1) the number of principals assigned to a given school over a number of years and its relationship to school characteristics; and (2) factors related to principal attrition. Both intend to elucidate school characteristics and factors associated with principals who stay for a long period (longer than the average) and with those who leave the principal role. Recent studies show that principal turnover is associated with higher rates of classroom teacher turnovers and lower student achievement gains, especially in schools impacted by poverty. Since changes in school leadership can be beneficial, this study also explored the relationships between having a new principal and school climate, classroom teacher turnover, and student academic performance in relation to school poverty and school complexity.

It is envisioned that a greater understanding of how characteristics of principals and school level factors are related to school climate, classroom teacher turnover, and student performance may inform policy solutions, thereby reducing unanticipated or disruptive rates of principal turnover.

Scope and Research Questions

The goal of this study is to: (1) provide an overview of the characteristics of 2018–2019 MCPS school principals at each school level (elementary, middle, and high school); (2) understand the factors associated with the likelihood of leaving; (3) explore the turnover of school principals in the last nine years in MCPS and determine its relationship with specific school factors; and (4) investigate if the experience of principals (new or veteran) in schools with different levels of complexity are associated with specific school factors.

The following research questions have been developed to address the objectives of the study:

1. What are the demographic characteristics of 2018–2019 MCPS school principals? Do these characteristics differ among schools with different levels of poverty and student demographic composition (school complexity)?
2. What is the principal attrition rate in MCPS? What principal and school characteristics are associated with the likelihood of a principal leaving the position?
3. What is the extent of principal turnover across MCPS schools? Do school factors (such as poverty, complexity, academic performance, and climate) differ between schools with three or more principals and schools with two or fewer principals in the last nine years?
4. Is veteran principal status associated with school factors, such as school climate, classroom teacher turnover, and academic performance in literacy and mathematics? Does this association vary by school complexity?

Overview of Selected Literature

What is principal turnover?

There is a growing body of research on principal turnover, its causes, and its consequences. The simplest definition of principal turnover is “that it occurs when a principal does not return to the same school” from one year to the next (Rangel, 2018). Broadly, principal turnover includes principal moves to other schools, districts, or positions, as well as exits from the school system altogether. The definition of turnover varies widely across studies.

Challenges to measuring and documenting administrator turnover

Differences between conceptualizing of teacher turnover and principal turnover. Researchers have identified a variety of challenges in measuring principal turnover. First, operationalization varies widely across many studies. These differences in conceptualization matter because studies that address different questions with different definitions limit our ability to compare these studies. Second, the most basic definition of principal turnover, that it occurs when a principal does not return to the same school from one year to the next, does not necessarily capture any information as to the nature of the departure (Rangel, 2018; Boyce & Bowers, 2016; Farley-Ripple et al., 2012). As such, the definition does not address certain questions, such as was the principal removed or did he or she leave on their own, and/or where did the principal relocate? Additionally, these studies do not tell us whether the principals who moved were satisfied with their jobs. A second challenge in measuring principal turnover relative to

teacher turnover relates to sample size; there is usually one principal in a given school, which limits the sample to be studied and the extent to which the findings can be generalized.

To address these shortcomings with a range of methods to measure principal turnover, Rangel (2018) discussed a variety of approaches to conceptualizing principal turnover, arguing that each of these measures calls for different types of outcome analysis procedures.

1. **Turnover as mobility.** The most common method is to focus on the mobility of principals.
 - a) Aggregate: movement and distribution of principals in schools across districts.
 - b) Dichotomous: leaving versus staying.
 - c) Multiple pathways: measures are applied at individual principal levels with multiple pathway measures such as staying, changing schools, or changing districts.
2. **Turnover as stability.** The second group of measures focus on stability, or the amount of time one principal remains at the same school. Of these, the first measure of retention is how long a principal is at a school before leaving (Rangel, 2018). A second and less common way to measure retention is to measure the proportion of time that a principal is at one school relative to the number of years in the dataset or that principal's career.

Notably, school stability measures differ from principal retention because they are measured at a school level. The dependent variable for school stability then becomes how many principals have been at a single school (Rangel, 2018).

Principal effectiveness, alternative positions, and pathways out of principal positions. Two researchers have shown that while the general research demonstrates the importance of principal effectiveness in school performance and the potentially negative effects of principal turnover, other research points to our limited understanding of those factors that lead principals to leave their schools and the relative effectiveness of those who stay and those who leave (Grissom & Bartanen, 2019; Battle & Gruber, 2010). Because a principal's effectiveness is an integral component, of whether principals leave or stay, this would suggest that principals are more likely to want to stay in their schools when they are more effective. At the same time, principals who are more effective may have more attractive outside options, including other principal positions or work outside of public schools.

The relative attractiveness of alternative positions increases the opportunity cost of staying in a current position, which may increase the probability that the principal will leave. Grissom and Bartanen (2019) investigated the association between principal effectiveness and principal turnover using longitudinal data from Tennessee and employing three measures of principal performance. Their results revealed that less effective principals are more likely to leave, on average, although they also found some evidence to indicate that the most effective principals had elevated turnover rates as well. The findings from this study also demonstrated the importance of differentiating pathways out of a principalship, which vary substantially according to effectiveness. The findings showed that low performers are more likely to exit the educational system or be downgraded to other school-level positions, whereas high performers are more likely to exit and be promoted to central office positions. However, there is little research to demonstrate that districts are equally likely to remove principals from school leadership positions when

they are found to be ineffective than to retain them in leadership positions or move them to a different school. On the other hand, a district may perceive benefits to moving an effective principal—for example, if they believe sending a high performer within the district to lead a persistently struggling school would increase overall district performance (Grissom & Bartanen, 2019).

Why principal turnover is a concern

Impact of principal turnover. While the literature is not clear regarding what is considered disruptive turnover per se, high levels of principal turnover are generally reported as one of the key challenges facing public schools and represent a serious issue across the country. Realizing that some principal turnover is good, expected, or planned, multiple studies point to the negative effects of high principal turnover. Some researchers have found that half of new principals leave by their third year and, when principals leave, the school underperforms the following year (School Leaders Network, 2014; RAND, 2012; Day, Gu, & Sammons, 2016). According to the 2012–2013 principal staffing survey from the U.S. Department of Education, more than 20 percent of principals left their schools in the first year, and more than 70 percent of principals have less than five years at their current schools (Boyce & Bowers, 2016). Levin and Bradley (2019) found that principal turnover is a serious issue across the country. They reported that the national average tenure of school principals was four years as of 2016–2017. This number masks considerable variations, with 35 percent of principals remaining at a given school for less than two years, and only 11 percent of principals remaining at a given school for 10 years or more. The most recent national study of public school principals found that, overall, approximately 18 percent of principals were no longer in the same position one year later. In high-poverty schools, the turnover rate is 21 percent. Principal turnover also varies by state (Levin & Bradley, 2019).

Indirect impact of principal turnover on student progress and teacher turnover. Some research notes that principal turnover can be disruptive to school progress, often resulting in higher teacher turnover and, ultimately, lower gains in student achievement (School Leaders Network 2014). Further, the relationship between principal turnover and declines in student outcomes is stronger in high-poverty, low achieving schools—those schools in which students primarily rely on education for their future success. In addition to the costs to students and teachers when good principals leave, schools and districts must devote time and resources to replace outgoing principals. The most robust evidence from the reviewed studies indicates that schools with higher percentages of students from low-income families, students of color, and low-performing students are more likely to experience principal turnover (Levin and Bradley, 2019).

Negative impact on student achievement. Several studies suggest that principal turnover can have a negative impact on student achievement. Béteille and colleagues (2012) analyzed approximately 400 schools over a five-year period. The findings indicate that when a school has a new principal, student make smaller achievement gains in mathematics compared to similar schools without a new principal. The relationship was more evident at schools where the principal was novice and students had a novice classroom teacher. Another research project, a quasi-experimental mixed methods study in six urban school districts done by Burkhauser and colleagues (2012), also uncovered a negative relationship. Their study reported that of those schools that experienced a principal transition, 50 percent also experienced a decline in achievement in the first year of the new principal.

Increases in teacher turnover. Principal support is said to be imperative to the retention of teachers in hard-to-staff schools (Grissom & Loeb, 2011). Other research found that principal turnover was related to an increase in teacher turnover among the most effective teachers (Ronfeldt, Loeb, & Wyckoff, 2013).

Actual and perceived cost of churn to school districts. The phenomenon of principal turnover, also known as “churn,” is costing schools a great deal in terms of money spent bringing new principals on board—at least \$75,000 per hire. On the other hand, there is some debate as to whether the turnover “signals a problem, progress, or business as usual” (School Leaders Network, 2014). The churn may be a signal that the principal’s job has become too difficult for one person to handle; others believe the churn may reflect districts’ greater willingness to rid schools of low-performing leaders.

Determinants of principal turnover

Factors associated with disruptive principal turnover. In an analysis of national survey data, Gates et al. (2019) reported that satisfied principals: (1) experience more positive working conditions; (2) have greater influence or decision-making authority; and (3) are content with their salaries. Dissatisfied principals reported a fourth condition: not having access to professional development. In addition to these conditions, Gates and colleagues found that a principal’s decision to move from a school could be influenced by accountability policies that issue sanctions associated with student outcomes, especially when unaccompanied by appropriate school support. In another recent study, Grissom and Brendan Bartanen (2019) used three measures of principal performance and demonstrated that less-effective principals are more likely to turn over, on average, though they also found some evidence that the most effective principals have elevated turnover rates as well.

The research by Gates et al. (2019) points to several reasons why principals leave their jobs, aside from retirement or dismissal.

1. Inadequate preparation and professional development.
2. Poor working conditions. A number of conditions can influence principals’ decisions about employment, including access to support, the complexity of the job and the amount of time needed to complete all necessary activities, relationships with colleagues, parents, and students, and disciplinary climate.
3. Insufficient salaries. Salaries matter to principals in choosing new positions and in deciding whether to stay.
4. Lack of decision-making authority. Principals are less likely to leave their positions when they believe they have greater control of their work environment and the ability to make decisions across a range of issues, including spending, teacher hiring and evaluation, and student discipline.
5. High-stakes accountability policies. Counterproductive accountability policies can create disincentives for principals to remain in low-performing schools and can influence principals’ mobility decisions.

Characteristics of the position. Job complexity may also be associated with turnover when principals must take on multiple roles and endure excessive work responsibilities. Research points to three characteristics of the principalship itself as predictors of principal turnover: degree of autonomy,

relationships, and the changing nature of the position (Grissom and Bartanen, 2019). The findings suggest that principals who perceive they lack autonomy are more likely to leave their positions.

Inadequate preparation and support

Principal induction and structures to support new principals. Principal turnover is highest in the first three years on the job. Allowing principals an induction period during those critical years may help to retain them and develop their skill set. The induction period should incorporate reduced workloads, in-school supervision, coaching on instructional leadership, and professional networks for new leaders.

Principal pipelines. According to Korach and Cosner (2017), principal pipeline activities are undertaken by a district and its partners to prepare, support, manage, and oversee the work of school leaders in order to ensure their effectiveness (Korach & Cosner, 2017). Typically, principal pipelines include four key components: (1) leader standards that guide all pipeline activities, (2) preservice preparation opportunities for assistant principals (APs) and principals (including not only the preservice training itself, but also recruitment and selection into these opportunities), (3) selective hiring and placement, and (4) on-the-job induction, evaluation, and support. In addition, according to the George W. Bush Institute (2019), the “pipeline must develop the capacity, culture, and infrastructure to sustain the work across components.” Principal pipeline activities include activities that are referred to as principal talent management or human capital management.

What happens when schools invest in principal pipelines? A recent study found compelling evidence indicating that principals, schools, and students benefit when districts set clear leadership expectations and employ those standards to hire, develop, and support strong leaders (Gates et al., 2019). This study was based on 50 of the largest national school districts, which were also minority-majority districts, serving a student population comprised of between 65 percent and 96 percent minorities. Those districts included Charlotte-Mecklenburg Schools in North Carolina, Denver Public Schools in Colorado, Gwinnett County Public Schools in Georgia, Hillsborough County Public Schools in Florida, the New York City Department of Education, and Prince George’s County Public Schools in Maryland. Overall, the researchers found that schools in the sample districts that received a newly placed principal outperformed comparison schools in both math and reading. The comparison were a set of similar schools that were not participating in the Principal Pipeline Initiative (PPI). Comparison schools were selected based on their similarity to treated schools in the PPI districts using matching methods. In addition, new principals in these districts were also 7.8 percentage points more likely to stay in their jobs for at least three years than new principals in comparison schools. The results indicate that if districts approach these pipeline activities strategically, paying close attention to each component and the coherence of their efforts, they can definitely set up their newly placed principals for success. Consequently, newly placed principals will be more likely to stay in their schools and principal positions. Student achievement effects were found across district, time, and school levels, and stronger effects were observed in schools that received newly placed principals.

School factors and principal characteristics

School and student characteristics. School performance, school conditions, school level and size, urbanicity, student race and ethnicity, student socioeconomic status, and the proportion of special education students at a school are found to be significant predictors of principal turnover.

School conditions and demographic makeup of student population. School conditions, though often defined differently across studies, were consistently related to less stability and greater mobility among principals. Béteille and colleagues (2012) found that principals prefer schools with fewer student discipline problems, among other school characteristics. Finally, through a descriptive analysis, Burkhauser and colleagues (2012) found that those principals in their sample who had left at the end of their first or second year reported lower levels of both staff cohesiveness and collaboration among school staff than those principals who stayed. Principals in high-performing schools (schools rated either exemplary or recognized by the state) were about 20 percent more likely than principals in low-performing schools (schools rated low performing or acceptable) to remain at the same school over a three-year period (1995–1998). Solano and colleagues (2010) found that in Delaware, a principal's tenure in his or her position increased by 0.02 years for every one-point increase in school math scores.

School makeup. Principals are more likely to leave schools with higher proportions of minority and low-income students. For example, a descriptive analysis of North Carolina schools uncovered the same trends: high-poverty schools have higher rates of principal turnover than low-poverty schools. This analysis also indicated that when principals moved from their first school, they often moved into schools with significantly less poverty, which suggests that poorer schools endure the most of principal inexperience (Clotfelter et al., 2006). Gates and colleagues (2006) found that in Illinois, a one-point increase in the percentage of minority students at a school was related to a 28 percent probability increase of changing schools and a 52 percent probability increase of leaving principal positions.

School level. School level also appears to matter, although the evidence is inconsistent across studies (Baker, 2010). Baker and colleagues' study indicates that middle school principals are less likely to be the most stable in terms of duration of employment. The also reported that middle and high schools principals are less likely to have left a principalship 10 years after certification. A different study reported that elementary school principals are 52 percent more likely than other principals to remain at the same school over a three-year period (Fuller et al., 2007).

Principal characteristics versus reasons for turnover. Researchers have identified several principal characteristics related to turnover. Specifically, a principal's gender, race, age, level of experience, education, and level of satisfaction are tied to principal turnover (Sun & Ni, 2016; Gates et al., 2006). Female principals are less likely than male principals to leave their schools (Sun & Ni, 2016). Meanwhile, African American principals in urban North Carolina districts have a lower probability of changing to a non-principal position (Gates et al., 2006). In Delaware, African American principals are 84 percent less likely than Caucasian principals to move to a new position within the same school district and are almost six times as likely to retire earlier (Solano et al., 2010). Using a dichotomous measure and national data, Tekleselassie and Villarreal (2010) found a weak nonlinear effect, indicating that younger and older principals are more likely than middle-aged principals to intend to switch schools or leave a principalship. The authors also found that older principals are more likely than younger

principals to intend to switch or leave a principalship altogether. In a study based in Illinois, the likelihood of a principal switching school in the same district increased with age. DeAngelis and White (2011) found that younger principals were more likely to have become superintendents after five years (OR=1.36) and after 10 years than older principals. Finally, principals older than 50 were less likely to remain in the same position after three years.

Challenges to the study of factors associated with principal recruitment, staffing, retention, and attrition. From the research review, it would appear that our general understanding of principal turnover remains relatively weak. The different ways in which turnover has been measured across studies; the limited number of studies on potentially important determinants, such as salary and professional development, as well as consequences, including student achievement and teacher turnover; the lack of consistency in many of the findings; the limited attention to those districts that have adopted models of rotating principals across schools; and the inclination to view longevity of a principal in a school as a proxy for effectiveness, all highlight the need for more research.

Methodology

Data sources

To address the objectives of this study, the Employee and Retiree Service Center (ERSC) provided data of staff serving as school principals in all MCPS schools. In addition, the authors retrieved school data from multiple MCPS databases, such as school demographic data from Schools-at-a-Glance (SAAG) as of FY 2018 and FY 2010, school performance data (Evidence of Learning - EOL) as of FY 2018, and 2017–2018 school climate survey data.

Study Samples

Three distinct analytical samples were created using the data provided by ERSC and school data. Samples used for each of the research questions are described below.

Research question 1 and 4. This study used the data of all MCPS staff serving as a principal as of November 2018 (N = 200) from 200 schools to address the research questions 1 and 4; the sample excluded principals of special schools. School demographic data from SAAG as of FY 2018, school performance data as of FY 2018, 2017–2018 school climate survey data, and proportion of 2018–2019 novice classroom teachers were merged to this analytical sample to incorporate school level factors in the analysis. Also, a variable indicating if a principal stayed in the same school for five years or more since 2015 and veteran/new principal status were calculated using the dataset for research question 2 and added to this analytical sample.

Research question 2. Data consisted of all MCPS staff who served as a principal from FY 2015 to FY 2018 (N = 309) in elementary, middle, high, and special schools. This data included demographic information of these individuals and, for those who left their position during this period; it included the type of exit (resignation or termination, promotion, transfer to Central Office, or retirement). Regarding school data, the following demographic variables from SAAG during FY 2015–2018 were merged to this analytical sample: percentage of students participating in the Free and Reduced-price Meals System

(FARMS), percentage of students participating in English for Speakers of Other Languages (ESOL), percentage of students receiving special education services, and school enrollment size.

Research question 3. This analytical sample was a school-level file and included the total number of principals that each MCPS elementary, middle, and high school ($N = 200$) had in the last nine years (from FY 2010 to 2019). In addition, principal turnover data included acting principals who were appointed to any school for a period longer than a month, and excluded principals who left a school due to retirement. School data, such as school demographic data from SAAG as of FY 2018 and FY 2010, school performance data as of FY 2018, and 2017–2018 school climate survey data were merged to this analytical sample.

Variables Used in the Study

The variables used in the analysis varied by research question. While some of the variables were directly provided by ERSC or retrieved from MCPS databases, some other variables were calculated by the authors in order to address the questions adequately.

Research question 1 and 4. Individuals (school principals as of FY 2018) were the unit of the analysis. The following individual-level variables were included in the analytical sample for this question:

1. Gender
2. Race/Ethnicity
3. Start date as a principal in MCPS
4. Years of experience as a principal in MCPS
5. Highest level of education
6. Whether the individual is a new principal in the last five years (calculated by using start date as principal)
7. Whether the individual was an internal or an external candidate (calculated by using historical principal data as well as all MCPS permanent position staff data, both provided by ERSC)
8. School (name and id) where the principal works
9. Whether a principal has moved schools since 2015 or since becoming a principal for those who started later than 2015 (stayed at the same school or not)

The following MCPS school-level variables were merged to the analytical sample by using the school id where the principal works.

1. School poverty. The authors used FARMS data as of FY 2018 to assign each of the schools, within each school level, to one of the following three levels of poverty:
 - a. *High poverty*: when the proportion of students receiving FARMS services in a particular school is greater than 20 points above the school level FARMS average (calculated separately for elementary, middle, and high school level).
 - b. *Medium poverty*: when the proportion of students receiving FARMS services in a particular school is within ± 20 points from the school level FARMS average (calculated separately for elementary, middle, and high school level).

- c. *Low poverty*: when the proportion of students receiving FARMS services in a particular school is lower than 20 points below the school level FARMS average (calculated separately for elementary, middle, and high school level).

A list of schools in each of these three levels of poverty as of 2018 can be found in Appendix A, Table A1 (elementary schools) and Table A2 (middle and high schools).

2. **School complexity.** School complexity, with four levels, was computed using factor analysis of school demographic data (ever FARMS, ESOL, special education, and percent total of Black or African American and Hispanic/Latino). Then, the factor scores were ranked and stratified into four groups (quartiles) within elementary, middle, and high schools on each school complexity score. Schools in the first quartile (level 1) represent the least complex schools whereas the schools in the fourth quartile (level 4) represent the most complex ones. A list of elementary, middle, and high schools in each of these four quartiles can be found also in Appendix A, Table A1 (elementary schools) and Table A2 (middle and high schools). Descriptive analysis of elementary, middle, and high school characteristics by complexity quartiles can be found in Appendix A, Table A3.
3. **School academic performance.** Evidence of Learning (EOL) data representing the percentage of students in a particular school who attained at the end of FY 2018 the EOL benchmark in literacy and mathematics was retrieved from Performance Matters.
4. **School climate.** By using the 2017–2018 school climate survey data, the school average satisfaction score was computed from aggregated responses of the staff in each school. This survey had 17 questions with answers from “Strongly disagree” (value of 1) to “Strongly agree” (value of 5). The minimum satisfaction score possible was 17 and the maximum satisfaction score possible was 85.
5. **Proportion of novice teachers by school.** The percentage of teachers in each of the schools during the 2018–2019 school year who had five years of teaching experience or less was computed. This calculation only included classroom teachers.

Research question 2. Similar to research question 1, school principals were the unit of analysis. Besides gender, race/ethnicity, and years of experience as a principal, additional individual-level variables were added to this analytical sample to address this research question appropriately.

1. Principal attrition or not (calculated by using principal data at the end of FY 2015, 2016, 2017, 2018, and 2019 (as of November 2018), and indicated if a principal has been in the same role continuously or not).
2. Reason for leaving a principal role, such as retirement, resignation or termination, promotion, or transfer to Central Office. For the analysis of factors associated to principal attrition, individuals who left their principal role due to retirement were removed from the sample.
3. Years of experience as a principal in MCPS (calculated as the years of experience of a principal in MCPS as of November 2018 for current principals or as of the end of the fiscal year they served for those who left the position earlier).
4. School (name and id) that the principal left or moved from (denoted as *origin* school).
5. School (name and id) that the principal moved to (denoted as *destination* school) when applicable.

Additional individual-level characteristics such as gender and race/ethnicity were added to this analytical file, as well as school factors (such as the percentage of students participating in FARMS, percentage of students participating in ESOL, percentage of students receiving special education services, and school enrollment size) as of FY 2015, 2016, 2017, and 2018. For individual records as of FY 2019 (as of November 2018), school factors as of FY 2018 were used.

Research question 3. Schools were the unit of analysis. The variables included in this analytical sample were the following:

1. Total number of principals in the last nine years (FY 2010-2019) by school, representing *principal turnover* (computed using inputs from historical principal data and staff turnover data, both provided by ERSC).
2. Schools with three or more principals in the last nine years versus schools with one or two principals in the last nine years. Elementary, middle, and high schools were grouped into two categories based on number of principals they had from FY 2010 to 2019 and the median (equaled to two principals across all school levels) was used as a threshold for this classification.

Similar to research question 1, the same school-level variables as of FY 2018 (school poverty, complexity, academic performance, and climate) were merged into the analytical sample to address this question. Because the data used for this question covered a broader period (from FY 2010 to 2019), school poverty and school complexity profiles using FY 2010 school and demographic information were also calculated and incorporated into the analysis to check whether the school profiles had changed substantially since FY 2010—which could impact the interpretation of the findings. The use of the FY 2010 complexity and poverty profile was intended simply to validate the conclusions obtained with data as of FY 2018.

Data Analysis Procedures by Research Question

Research question 1. To address question 1, descriptive analyses as well as 2 by 2 contingency tables procedures (Chi-square) were used to: (1) summarize information on demographic characteristics and (2) to test whether there is a significant relationship between principal's characteristics of race/ethnicity, gender, years of experience, and their school assignments. The relationships between the categorical demographic variables (race/ethnicity, gender, and level of experience, school poverty, and school complexity levels) were examined. Because the Chi-square test assumes the expected value for each cell is five or higher, analyses related to race/ethnicity were conducted only for Black or African/American and White principals. The number of principals in the other race/ethnicity categories were too few to be included in the analyses related to the Chi-square tests.

Research question 2. This question analyzed: (1) the principals' attrition rate in MCPS per year, defined by the percentage of staff who left their principal role from FY 2015 to 2018; and (2) the composition of this principal attrition rate by retirement, promotion and transfer to other MCPS office, and resignation/termination. Later, a dataset with all MCPS staff who served as principals from FY 2015 to 2019 (as of November 2018), excluding those who retired, was compiled to conduct a binary logistic regression to explore the factors associated with the likelihood of principals leaving the principal position. The dichotomous variable "Attrition or not" was the dependent variable or outcome, and

individual-level characteristics (such as gender, race/ethnicity, and years of principal experience in MCPS) were incorporated in the final model as predictors. Regarding school-level characteristics, only percentage of students receiving FARMS services and special education were included in the final model as predictors. The percentage of Black or African American or Hispanic/Latino students, the percentage of students participating in English for Speakers of Other Languages (ESOL), and school enrollment size were significantly correlated with FARMS. To prevent the issue of multicollinearity, these variables were excluded from the final model.

The binary logistic regression yielded a regression coefficient, statistical significance, and the odds ratios for each of the predictors. Cohen's *d* effect sizes were used to determine if the odds ratios were large enough to be of practical significance. The following formula was used to calculate the effect size (*d*) from the odds ratio:

$$d = \frac{\ln(OR)}{\pi/\sqrt{3}}$$

For positive relationships between predictors and the dependent variable, a Cohen's *d* effect size of .20 (or an odds ratio of 1.44) was considered small, a Cohen's *d* of .50 (or an odds ratio of 2.47) was considered medium, and a Cohen's *d* of .80 (or an odds ratio of 4.25) was considered large. For negative relationships, a Cohen's *d* effect size of -.20 (or an odds ratio of .70) was considered small, a Cohen's *d* of -.50 (or an odds ratio of .41) was considered medium, and a Cohen's *d* of -.80 (or an odds ratio of .24) was considered large. These thresholds were used to describe the magnitude of the odds ratios, indicating whether it is of practical significance to educators.

Research question 3. The principal turnover in MCPS from FY 2010 to 2019, defined as the number of principals per school during this nine-year period, was addressed by this question. A distribution of elementary, middle, and high schools by principal turnover was reported to identify the schools with more than two principals (median) and the schools with one or two principals during the same period. Further, the relationships between school factors and school principal turnover were examined. For school factors that were categorical, relationships were tested via Chi-square tests or Fisher Exact tests (when values in some categories were less than five). For school factors that were continuous, average differences between schools with more than two principals and schools with one or two principals since FY 2010 were tested via independent sample t-tests, assuming normality of distributions.

Research Question 4. To address question 4, a factorial ANOVA was conducted to assess how differences in the interval variables of school climate, percent of novice teachers in the school (teacher turnover), and proportion of students meeting the 2018 end-of-year EOL benchmarks varied by principal veteran status and school complexity levels.

A factorial ANOVA was used because there were two or more categorical independent variables and interval dependent variables. For instance, school complexity had four levels: low complexity (level 1), level 2, level 3, and high complexity (level 4). The goal was to explore the effects of two independent variables simultaneously and how these variables interact relative to school climate, teacher turnover (percent novice), and school performance. *Post Hoc* tests were used to conduct a separate comparison between factor levels. The analyses report the main effect of each variable as well as any significant

interactions at $p < .05$ among the variables. In addition, estimated marginal means were provided to help visualize the interaction effects, if any. After considerable exploration, a couple of adjustments were made to the initial design. For example, for the middle and high school levels, the school complexity variable was reduced from four levels to two levels—to accommodate the small number of schools in each category. In addition, analyses by school poverty profiles could only be completed for the elementary.

Strengths and Limitations of the Methodology

Delimitations. Delimitations are also factors that can restrict the questions a researcher can address/answer, as well as the inferences that can be drawn from the findings. Because of the small number of middle and high schools, the complexity levels for middle and high school had to be collapsed from four to two levels in order to have sufficient number of schools at each level to address research question 4. Similarly, analyses by race/ethnicity were stratified by Black or African American and White because the number of principals of other races were very few (8%).

Strengths. One of the strengths of this study was the use of multiple years of data to understand principal turnover and attrition in MCPS and to explain the likelihood of principals leaving their role in MCPS. For instance, research question 3 used historical data from FY 2010 to FY 2019 (as of November 2018) to determine the number of principals per school. Similarly, research question 2 used staff data from FY 2015 to 2019 to create an aggregated dataset with all MCPS staff who served as a principal for the last four years. The construction of complex datasets, such as the one to address research question 2, required linking school data information to specific school years between FY 2015 and 2019.

Another strength lay in the analytical procedures used by this study. Hypothesis tests and factorial ANOVA were conducted when appropriate to test relationships, and logistic regression was utilized to determine the possible factors that might be tied to the likelihood of principals leaving their role in MCPS.

Limitations. One of the limitations concerned the sample size, especially if the analysis required certain disaggregation by categories. For instance, for research question 3, although analytical procedures were conducted for each of the school levels, the analysis concerning middle and high schools were limited due to small number of middle and high schools in MCPS (40 and 26, respectively). For instance, the number of middle and high schools among schools with more than two principals in the last nine years was limited when analysis was conducted by school poverty or complexity.

In addition, data on principals who had participated in principal induction program were not available and could not be used in the analyses. Therefore, specific efforts from MCPS and its impact in retaining principals in MCPS could not be assessed by this study.

Findings

The findings of this report are presented by research question.

Research question 1: What are the demographic characteristics of 2018–2019 MCPS school principals? Do these characteristics differ among schools?

Characteristics of 2018–2019 School Principals

There were 200 staff in principal positions in elementary, middle, and high schools during the 2018–2019 school year (excluding special schools). Table 1 provides an overview of characteristics of these 200 elementary, middle, and high school principals. Corresponding to the number of schools, elementary principals outnumbered middle and high school principals by a ratio of 3:1 and 5:1 respectively.

Gender. Over 64% of 2018–2019 principals were female. The percentage of female principals was higher at the elementary (67%) than at the middle (65%) and high school (50%) levels.

Racial and ethnic diversity. More than one half (59%) were White and 34% were Black or African American. Principals who are Hispanic/Latino, Asian, or who identify to two or more races/ethnicities made up less than 10 percent of all MCPS principals.

Age. Overall, close to one half of principals were in the 40–49 years age category (48%). When analyzed across levels, majority of principals at the middle (58%) and high school (62%) levels and over 40% of elementary principals were in the 40–49 years age category. The percentage of principals who were 60+ years was less than 20% across the three levels. No principals were less than 30 years old.

Educational attainment. All the principals had advanced degrees—either a master’s or an equivalent degree, or a doctorate degree regardless of the school level.

Internal or external recruitment. Nearly all the principals (96%) were recruited and hired internally from MCPS staff. This percentage varied slightly across the school levels. All the middle school principals were recruited internally.

Experiences as principals. More than half of all principals (56%) had been principals for five years or less (Table 1). Figure 1 illustrates the relative distribution of principals by years of experience as a principal, by school level. At each level, over one-half of the principals (55% of elementary, 63% of middle school, and 62% of high school) had five or fewer years of experience as a principal. At each level, around a quarter of the principals had 5–10 years of experience as principals. Seven percent of elementary, 3% of middle school, and 4% of high school principals had 15 or more years of experience in MCPS.

Table 1. Overview of Characteristics of 2018–2019 principals in MCPS

Characteristics	Elementary (N=134)		Middle (N=40)		High (N=26)		All	
	N	%	N	%	N	%	N	%
Gender								
Male	44	32.8	14	35.0	13	50.0	71	35.5
Female	90	67.2	26	65.0	13	50.0	129	64.5
Race/ethnicity								
Black or African American	42	31.3	15	37.5	10	38.5	67	33.5
Asian	3	2.2	2	5.0	0	0.0	5	2.5
Hispanic/Latino	4	3.0	4	10.0	1	3.8	9	4.5
Two or More Races	0	0.0	1	2.5	0	0.0	1	0.5
White	85	63.4	18	45.0	15	57.7	118	59.0
Age category								
20 - 29 years	0	0.0	0	0.0	0	0.0	0	0.0
30 - 39 years	15	11.2	4	10.0	0	0.0	19	9.5
40 - 49 years	56	41.8	23	57.5	16	61.5	95	47.5
50 - 59 years	40	29.9	11	27.5	5	19.2	56	28.0
60+ years	23	17.2	2	5.0	5	19.2	30	15.0
Educational achievement								
Master or master equivalent	119	88.8	31	77.5	19	73.1	169	84.5
Doctorate	15	11.7	9	22.5	7	23.1	31	14.5
Veteran/New Principal Status								
Veteran	62	46.6	15	37.5	10	38.5	87	47.7
New principal (five years or less)	71	53.4	25	62.5	16	61.5	112	56.3
Internal or External recruitment								
Internal	125	94.0	40	100.0	25	96.2	190	95.5
External	8	6.0	0	0.0	1	3.8	9	4.5
Mobility as a principal								
Changed schools since 2015	13	9.7	4	10.0	8	30.8	25	12.5
Stayed at same school since 2015	121	90.3	36	90.0	18	69.2	175	87.5

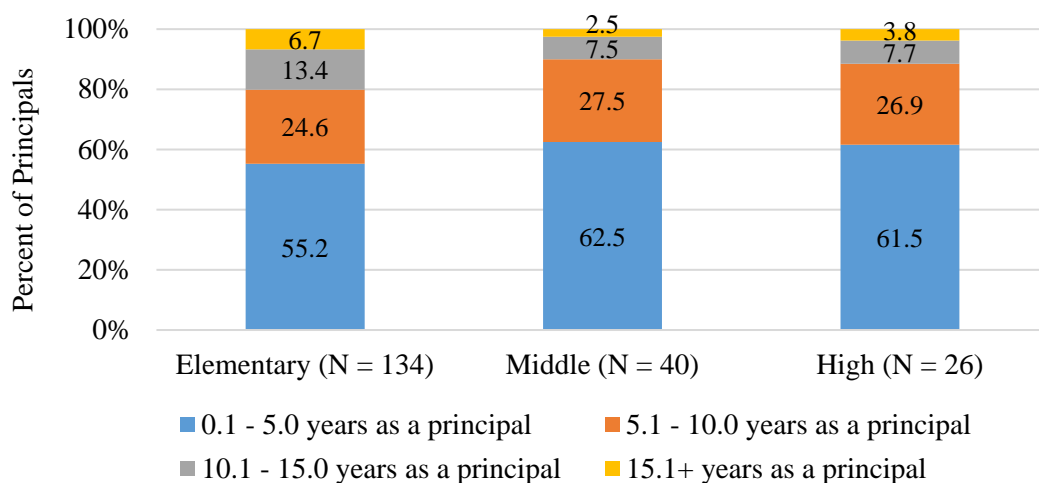


Figure 1. Years of experience as a principal, by school level

Figure 2 illustrates the relative distribution of principals who stayed at the same school in the last four years or since becoming a principal (for those who started after FY 2015), by school level. According to it, nearly all the principals at the elementary (90%) and middle (90%) school levels had stayed in the same position at the same school since 2015 relative to 69% at the high school level.

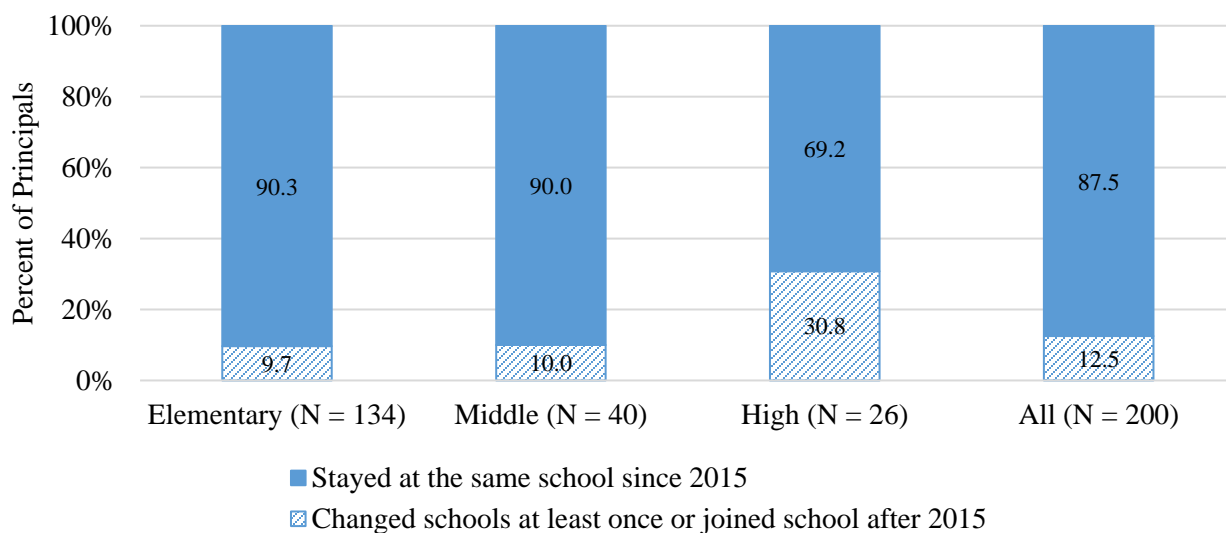


Figure 2. Relative proportions of principals who have been at the same school since 2015, by school level

Characteristics of New Principals (Novice)

Because the proportion of new principals is an indirect reflection of turnover in the principal positions, this section examined the characteristics of principals with less than five years of experience as principals in MCPS. One hundred twelve principals, representing 56% of the principals, had five years or less of experience as principal in MCPS.

Based on Table 2 below, the proportion of women among the recent principal assignments or hires was lower than in the general population of principals (59% vs. 65%) (See also Table 1). Corresponding to the fact that there are more elementary schools relative to middle and schools, the majority of the new principals were in elementary schools (63%). The proportion of Black or African American were almost similar (35% vs. 34%) (See also Table 1) whereas the proportion of White principals was very similar to the entire MCPS principal population (60%). All principals new to their position in the last five years had advanced degrees. Only 4% of the new principals were external candidates.

Table 2. Overview of Demographic Characteristics of Principals with Five Years of Experience or Less (N = 112)

Characteristics	N	%
Level		
Elementary	71	63.4
Middle	25	22.3
High school	16	14.3
Gender		
Male	46	41.1
Female	66	58.9
Race/Ethnicity		
Black or African American	39	34.8
Asian	3	2.7
Hispanic or Latino	3	2.7
Two or More Races	0	0.0
White	67	59.8
Age Category		
20 - 29 years	0	0.0
30 - 39 years	17	15.2
40 - 49 years	62	55.4
50 - 59 years	27	24.1
60+ years	6	5.4
Educational Attainment		
Master or master equivalent	96	85.7
Doctorate	16	14.3
External Candidate		
Internal	108	96.4
External	4	3.6

Differences in principals' gender and race/ethnicity by school complexity

Gender. The analyses for gender and school complexity were not significant, indicating there was no relationship between either male or female principals being assigned to low or high complexity schools ($p < .05$) (Appendix B, Table B1).

Race/ethnicity. As stated in the methodology, only about 8% of the principals were not White or Black or African American. Therefore, the data on those principals were not amenable to tests relating race/ethnicity to school assignment. The tests for association between race/ethnicity and school assignment were conducted only for the principals identified as either White, or Black or African American. Figure 3 represents the relative distribution of principals by race/ethnicity and school complexity at the elementary school level. The relationship between being a Black or African American principal and being in the most complex schools was significant ($\chi^2 (3, N = 42) = 17.9, p < .05$) at the elementary school level. This finding indicated that there were significantly higher proportions of Black

or African American principals (41% vs. 16%) serving in the most complex elementary schools relative to proportions of White peers. Conversely, the relationship between being a White principal and being in least complex schools was also significant ($\chi^2 (3, N = 85) = 18.5, p < .05$) at the elementary school level, indicating a significantly higher proportions of White principals were serving in the low complexity elementary schools (33% vs. 7%) relative to proportions of Black or African American peers in low complexity schools.

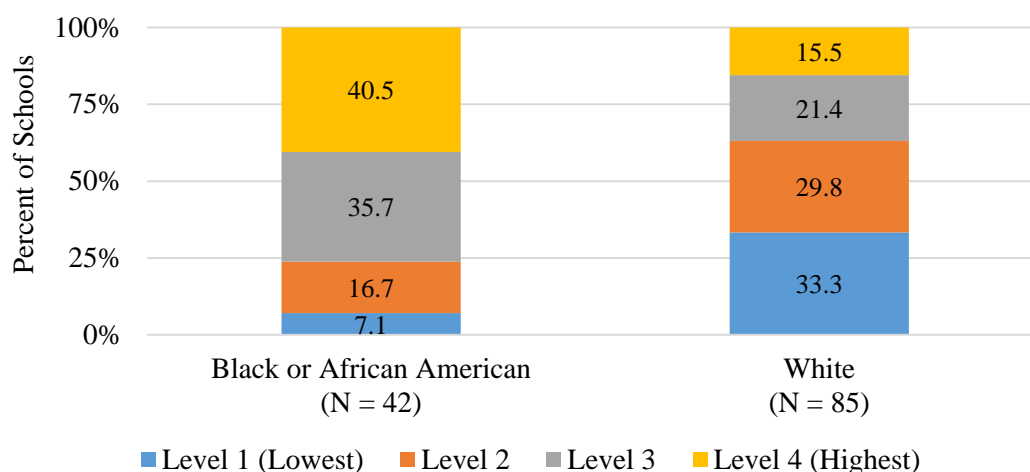


Figure 3. Relative proportions of elementary school principals by race/ethnicity and school complexity

Differences in principals' gender, experience, and race/ethnicity by school poverty levels.

Gender. Results of the analysis examining principals' gender by school poverty levels were similar to results by school complexity. The analyses for gender and school poverty were not significant in any of the school levels, indicating no relationship between either male or female principals being assigned to low, medium, or high poverty schools ($p > .05$). Results are detailed in Appendix B, Table B2).

Experience. No significant differences in the relationship between principals' years of experience and school poverty level were found at the elementary, middle, or high school levels ($p > .05$). Results are also detailed in Appendix B, Table B3).

Race/ethnicity. The race/ethnicity of principals was significantly associated with the level of school poverty at the elementary school level. Figure 4 illustrates the relative distribution of elementary school principals by race/ethnicity and school poverty. A higher proportion of Black or African American principals (38% vs. 18%) were significantly likely to be housed in high poverty elementary schools ($\chi^2 (2, N = 42) = 20.4, p < .01$) relative to White peers. Conversely, the proportion of White principals in low poverty schools was higher (44% vs. 5%) relative to proportions of Black or African American peers ($\chi^2 (2, N = 85) = 17.6, p < .05$). No significant difference was found in the relationship between race/ethnicity and school poverty levels in middle and high schools.

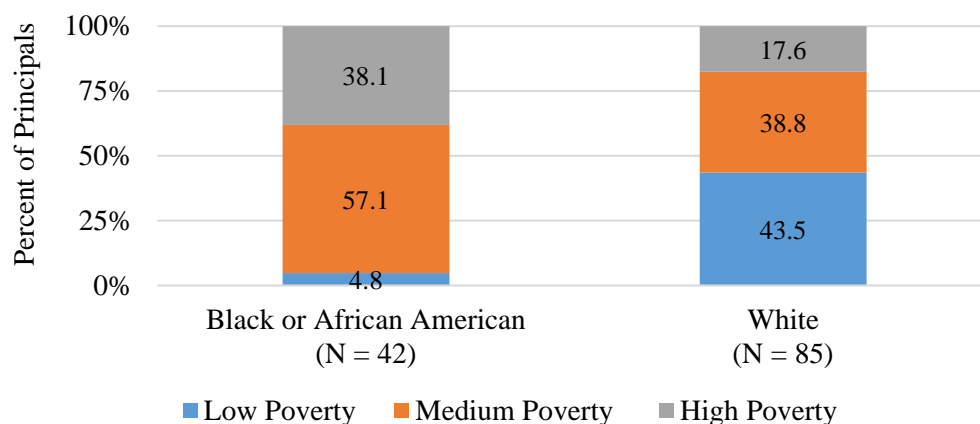


Figure 4. Relative proportions of Black or African American and White elementary school principals by race/ethnicity and school poverty

Research question 2: What is the principal attrition rate in MCPS? What principal and school characteristics are associated with the likelihood of a principal leaving the position?

Principals' attrition rate from FY 2015 to FY 2018

Figure 5 shows the principals' attrition rate in MCPS at the end of the fiscal years between FY 2015 and 2018. Principals' attrition rate is defined as the percentage of principals who left their role due to retirement, promotion, transfer to other MCPS office, or resignation/termination, over the total number of MCPS schools every year.

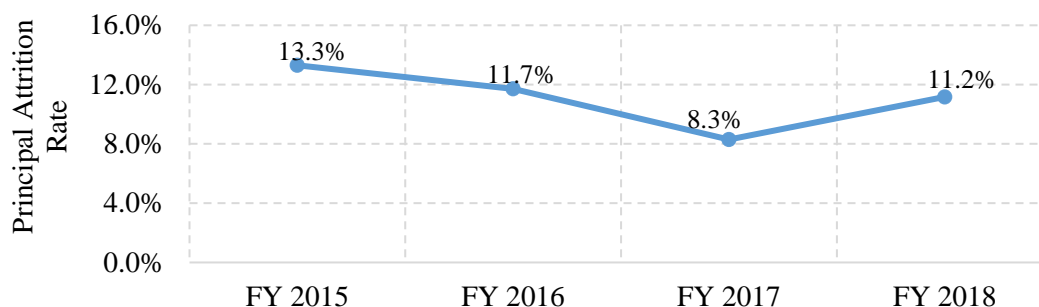


Figure 5. Principals' attrition rate in MCPS from FY 2015 to 2018

In FY 2018, 11.2% of MCPS staff (23 out of 206 principals) left their role as principal, which represents a decrease of 2.1 percentage points compared to FY 2015 (Figure 5). The lowest percentage was reached in FY 2017 when 8.3% of staff (17 out of 205 principals) left their role as a principal in MCPS. Several

reasons contributed to this decrease; however, fewer principals retired in recent years compared to FY 2015, as Figure 6 shows below.

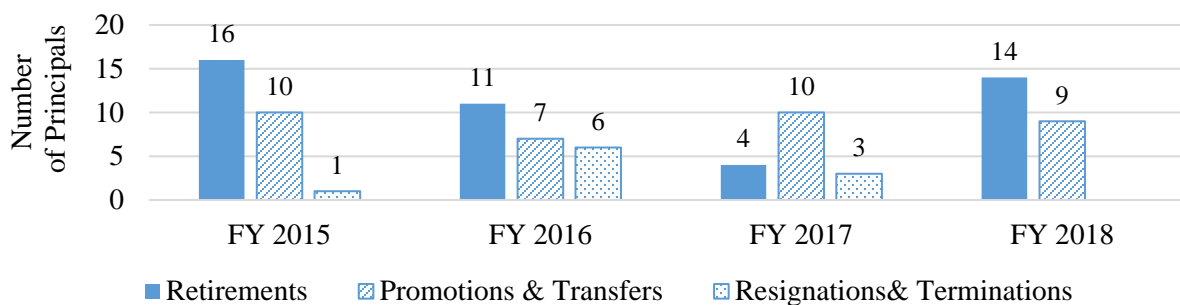


Figure 6. Composition of principals' attrition rate in MCPS from FY 2015 to 2018 by retirements, promotions, transfers to other MCPS offices, and resignations/terminations

Factors associated with the likelihood of principals leaving the position

Table 3 shows the factors associated with the likelihood of principals leaving their position. This analysis included all MCPS staff who stayed as a principal or left their principal role from FY 2015 to 2019 (as of November 2018) due to promotion and transfer, as well as resignation or termination. Records of principal attrition due to retirement were excluded from the analysis.

Percentage of students receiving FARMS services was the only predictor that resulted in a statistically significant coefficient ($p < .05$). Principals who are located in schools with a high percentage of students receiving FARMS services were more likely to leave the principal role relative to their peers located in a school with a low percentage of FARMS students. Table 3 also shows that: (1) male principals and those with more years of experience in MCPS were less likely to leave in the position, and (2) Black or African American principals and those who are located in schools with a high percentage of students receiving special education were more likely to leave the position. However, none of these results was significant or practically significant.

Table 3. Descriptive Statistics and Logistics Regression Results of Principals Leaving the Principal Role vs. Staying from FY 2015 to FY 2019

Variables	Descriptive Statistics by Group						Logistic Regression Results			
	Stayed as a principal (N = 206)			Left principal role (N = 52)			95% Conf. Intervals			
Categorical variables	N	n	%	N	n	%	β (SE)	Odds Ratio (OR)	Lower	Upper
Male	206	73	35.4	52	17	32.7	-0.12 (.34)	.89	.46	1.71
Black or African American	206	68	33.0	52	23	44.2	.26 (.34)	1.30	.67	2.52
Continuous variables	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio (OR)	Lower	Upper
Years of principal experience in MCPS	206	6.2	4.6	52	6.0	3.1	-.01 (.04)	.99	.93	1.07
% of students receiving FARMS	206	36.4	23.9	52	45.6	23.7	.01* (.01)	1.02	1.00	1.03
% of students receiving special education	206	14.0	14.0	52	14.7	17.0	.01 (.01)	1.01	.98	1.02

* $p < .05$. SD = Standard deviation. SE = Standard error.

None of the odds ratio values had magnitudes of practical significance.

Note. Odds ratios (OR) are based on the binary logistic regression model. The OR indicates how the predictor variable is related to the odds that a MCPS staff left the principal role versus staying in that role. Values greater than 1 indicate that increases in the predictor variable are associated with higher odds that a principal leave the position. Values less than 1 indicate that increases in the predictor variable are associated with lower odds.

Research question 3: What is the extent of principal turnover across MCPS schools? Do school factors (such as poverty, complexity, academic performance, and climate) differ between schools with more than two principals and schools with one or two principals in the last nine years?

Principal turnover in MCPS from FY 2010 to FY 2019

Principal turnover is defined as the total number of principals in a particular school in a nine-year period (from FY 2010 to 2019). Principal turnover also includes any individual acting as a principal for a duration longer than one month and excludes those who left a school due to retirement.

The distribution of schools by principal turnover varied based on the school level (Figure 7). For instance, almost half of MCPS elementary schools (61 schools) report having the same principal for the last nine years, whereas only a quarter of MCPS middle schools (10 schools) report having the same principal during the same period. When schools are grouped into two categories (with three or more principals and two or fewer principals in the last nine years), 25 elementary schools, 15 middle schools, and four high schools report having more than two principals since FY 2010.

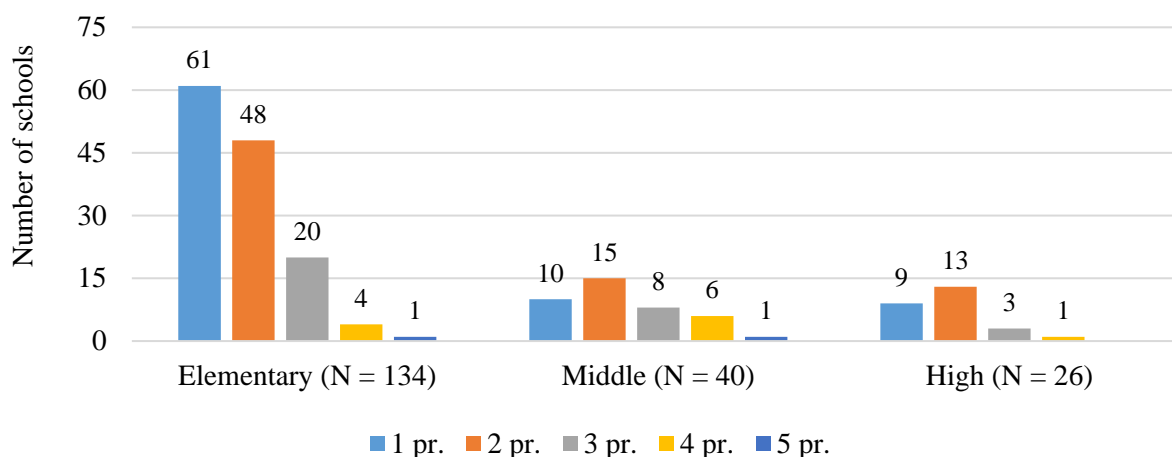


Figure 7. Distribution of Elementary, Middle, and High Schools by Principal Turnover from 2010 to 2019

School factors related to principal turnover

School Poverty. The association between principal turnover and school poverty (measured by the percentage of students receiving FARMS services as of FY 2018) varied by school level.

At the elementary level, more than half of the schools with more than two principals in the last nine years (14 out of 25) were schools with high levels of poverty, compared to the 18% of the schools with one or two principals (20 out of 109) and high levels of poverty (Figure 8). Almost similar distributions were observed when FARMS data as of FY 2010 was used. The association between principal turnover and school poverty (measured by FARMS data as of FY 2018 and 2010) were statistically significant ($p < .05$) for elementary schools. Since different tests were used depending on the number of observations per cell (Chi-square or Fisher Exact Tests), results are detailed in Appendix C Table C1.

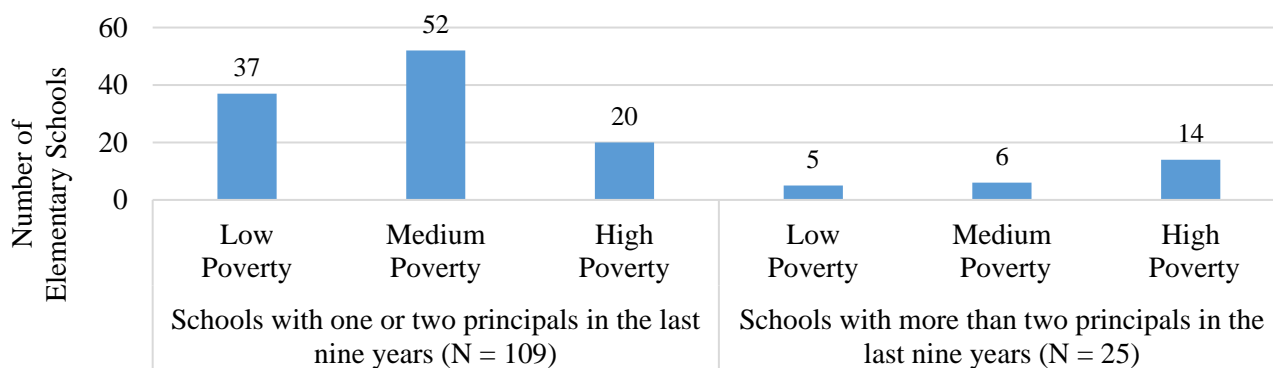


Figure 8. Distribution of Elementary Schools by Principal Turnover and by Poverty Level using FARMS data as of FY 2018

For middle schools, 13% of schools with more than two principals in the last nine years (2 out of 15) were schools with high levels of poverty, whereas 28% of schools with one or two principals (7 out of 25) were schools with high levels of poverty (Figure 9). Almost similar distributions were observed when FARMS data as of FY 2010 was used, and the association between principal turnover and school poverty (measured by FARMS data as of FY 2018 and 2010) were not significant ($p > .05$) for middle schools (Appendix C, Table C1).

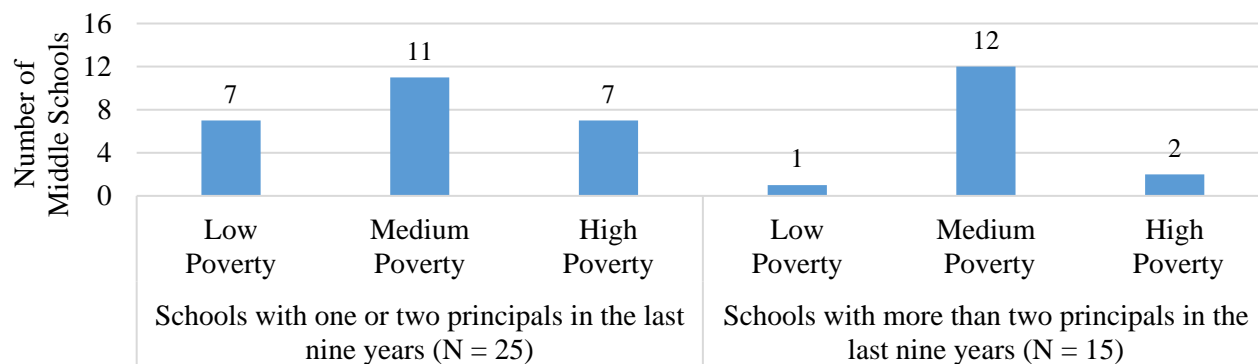


Figure 9. Distribution of Middle Schools by Principal Turnover and by Poverty Level using FARMS data as of FY 2018

At the high school level, half of schools with more than two principals in the last nine years (2 out of 4) were schools with high levels of poverty, whereas around 20% of schools with one or two principals (4 out of 22) were schools with high levels of poverty (Figure 10). The association between principal turnover and school poverty (measured by FARMS data as of FY 2018) was not significant ($p > .05$). When FARMS data as of FY 2010 was used to measure poverty instead, the school distribution by principal turnover and levels of poverty changed a little; however, the relationship remained not significant ($p > .05$) (Appendix C, Table C1).

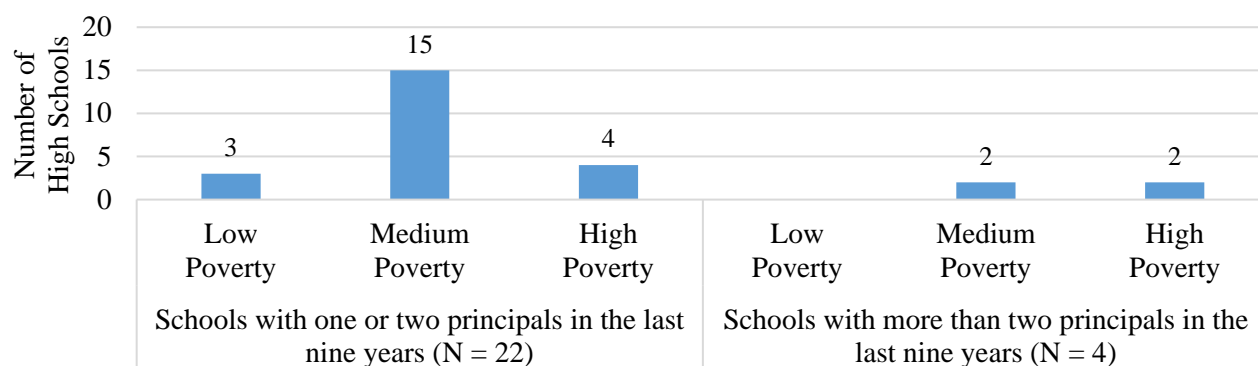


Figure 10. Distribution of High Schools by Principal Turnover and by Poverty Level using FARMS data as of FY 2018

School Complexity. The association between principal turnover and school complexity (measured by sociodemographic variables as of FY 2018) also varied by school level; however, the proportion of schools with more than two principals in the last nine years was higher among high complexity schools than low complexity schools across all levels.

In elementary schools, 72% of schools with more than two principals in the last nine years (18 out of 25) were high complexity schools (levels 3 and 4), whereas 45% of schools with one or two principals (49 out of 108) were also high complexity schools (levels 3 and 4) (Figure 11). A similar conclusion was observed with school complexity data as of FY 2010. However, the association between principal turnover and school complexity (measured as of FY 2018 and 2010) were not significant ($p > .05$) for elementary schools (Appendix C, Table C2).

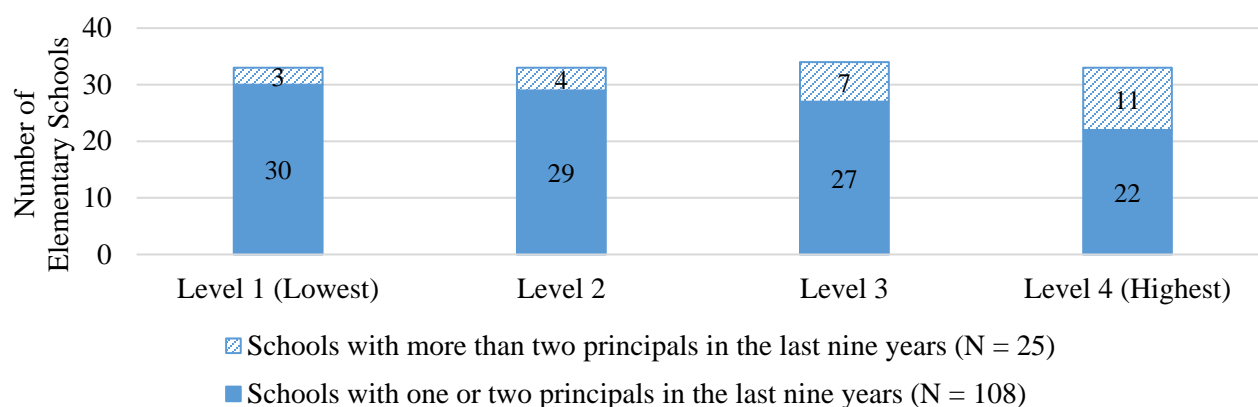


Figure 11. Distribution of Elementary Schools by Principal Turnover and by School Complexity using data as of FY 2018

At the middle school level, 60% of schools with more than two principals in the last nine years (9 out of 15) were high complexity schools (levels 3 and 4), whereas 44% of schools with one or two principals (11 out of 25) were also high complexity schools (levels 3 and 4) (Figure 12). A similar distribution was observed when complexity data as of FY 2010 was used. The association between principal turnover and school complexity appeared to be not significant ($p > .05$) with complexity data as of FY 2018; however, it was significant with complexity data as of FY 2010 (Appendix C, Table C2).

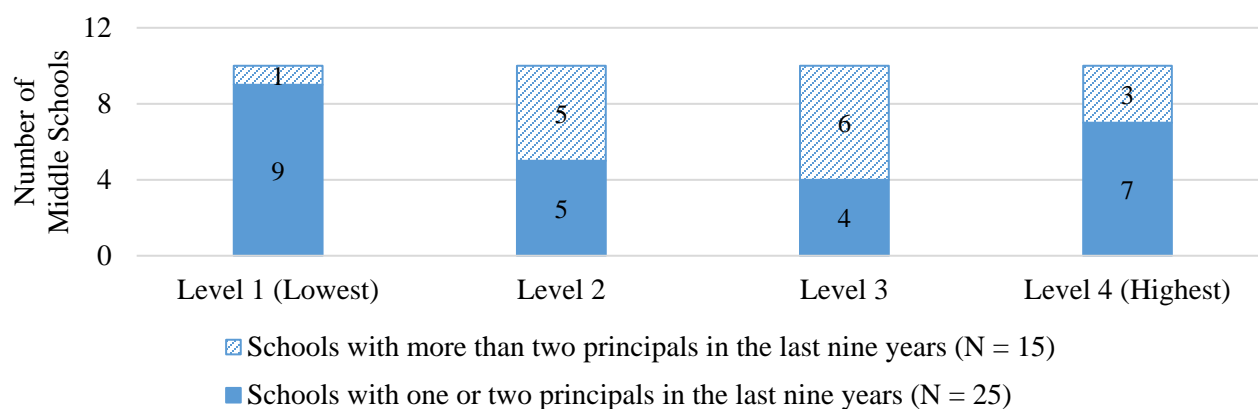


Figure 12. Distribution of Middle Schools by Principal Turnover and by School Complexity using data as of FY 2018

For high schools, 75% of schools with more than two principals in the last nine years (3 out of 4) were high complexity schools (level 3 and 4 combined), whereas 45% of schools with one or two principals (10 out of 22) were also high complexity schools (level 3 and 4) (Figure 13).

The association between principal turnover and school complexity was shown not to be significant ($p > .05$) for high schools when school complexity was measured as of FY 2018 or FY 2010. (Appendix C, Table C2).

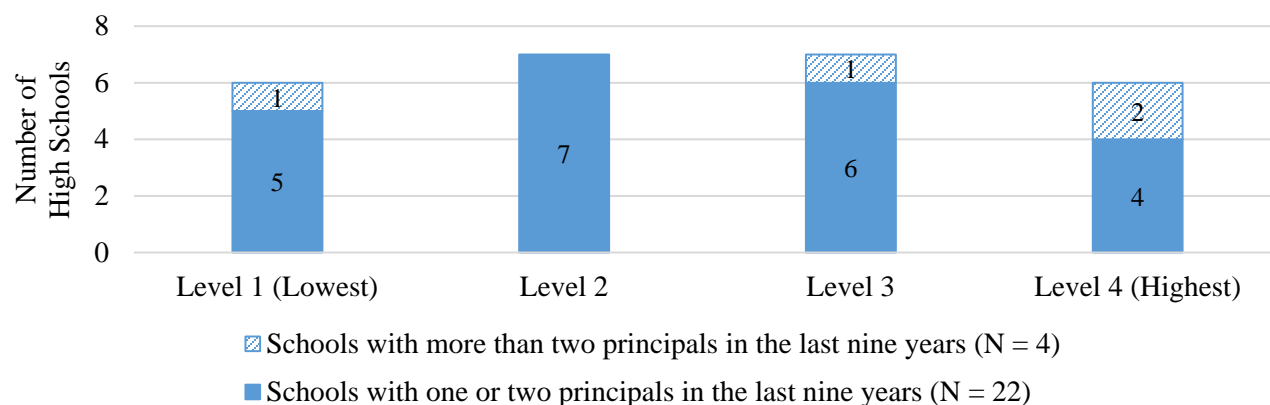


Figure 13. Distribution of High Schools by Principal Turnover and by School Complexity using data as of FY 2018

Academic performance. Table 4 shows the average percentage of students meeting at least two of the three 2018 End-of-Year Evidence of Learning (EOL) measures in literacy and mathematics at: (1) schools with one or two principals in the last nine years, and (2) schools with more than two principals during the same period. Schools with more than two principals, especially elementary and high schools, had on average a lower percentage of students meeting at least two of the three End-of-Year EOL measures in literacy and mathematics compared to schools with one or two principals. However, these percentage average differences between these two groups of schools appeared to be significant ($t = 3.18$, $df = 132$, $p < .01$ for literacy; $t = 2.69$, $df = 132$, $p < .05$ for mathematics) only for elementary schools but not for middle or high schools (Appendix C, Table C3).

Table 4. Average Percentages of Students Meeting at Least Two of the Three 2018 End-Of-Year Evidence of Learning (EOL) Measures in Literacy and Mathematics in Schools with One or Two Principals in the Last Nine Years and Schools with More Than Two Principals in the Last Nine Years

School Level	Literacy		Mathematics	
	Schools with 1–2 principals in the last 9 years	Schools with > 2 principals in the last nine years	Schools with 1–2 principals in the last 9 years	Schools with > 2 principals in the last nine years
	Mean %	Mean %	Mean %	Mean %
Elementary (N = 134)	71.1	61.5	69.7	61.3
Middle (N = 40)	70.7	69.3	66.3	65.2
High (N = 26)	81.9	74.4	68.8	61.7

School climate. Table 5 shows the average percentage of the climate satisfaction score at: (1) schools with one or two principals in the last nine years, and (2) schools with more than two principals during the same period. Schools with more than two principals had on average a slightly lower climate satisfaction score compared to schools with one or two principals. However, these percentage average differences between these two groups of schools were not statistically significant ($p > .05$) in any of the school levels (Appendix C, Table C4).

Table 5. Average Percentage of the Climate Satisfaction Score in Schools with One or Two Principals in the Last Nine Years and Schools with More Than Two Principals in the Last Nine Years

School Level	Schools with 1–2 principals in the last nine years	Schools with > 2 principals in the last nine years
	Mean %	Mean %
Elementary (N = 134)	63.6	61.0
Middle (N = 40)	62.1	59.7
High (N = 26)	59.6	57.2

Research question 4. Is veteran principal status associated with school factors, such as school climate, classroom teacher turnover, and academic performance in literacy and mathematics? Does this association vary by school complexity?

Differences in school factors by veteran principal status and school complexity

The results for the analyses related to veteran principal status and school complexity are presented by school level. There was no significant main effect of veteran principal status or differences in school climate, classroom teacher turnover, and academic performance (literacy and mathematics) associated with having a new or veteran principal ($p > .05$) in any of the school levels.

Elementary School Level

School Climate. The variation in climate scores was significantly associated with school complexity but not with veteran principal status, indicating there was no significant main effect of veteran principal status or differences in school climate ($p > .05$) in any of the school levels. The largest difference in climate scores by veteran principal status, though not significant, was observed in schools at a medium low complexity level (level 2). However, a two-way analysis of variance yielded a significant main effect for the school complexity ($F(1, 126) = 15.45, p < .05$) on school climate; such that the average school climate scores were significantly higher across the levels of school complexity regardless of principal tenure (Figure 14). Pairwise comparison showed significant differences between each complexity level—whereby scores decreased as the complexity levels increased from level 1 to level 4 regardless of principal tenure. Summary statistics, tests of Between-Subjects Effects, and paired comparisons are presented in Appendix D, Tables D1-D2.

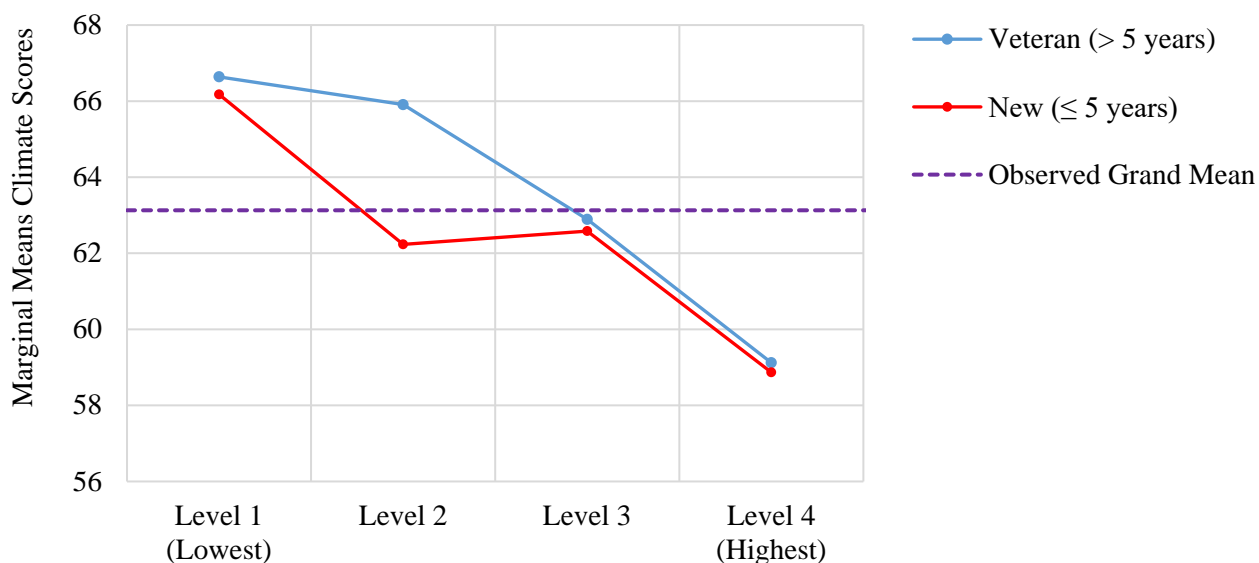


Figure 14. Estimated marginal means climate scores by veteran principal status and school complexity in elementary schools

Note. The dashed line represents the grand mean for climate scores

Classroom Teacher Turnover. The variation in climate scores was significantly associated with school complexity but not with veteran principal status. The main effect of veteran principal status on classroom teacher turnover and the interaction between veteran principal status and school complexity on teacher turnover were not statistically significant ($p > .05$). However, the findings showed that classroom teacher turnover was significantly associated with level of school complexity ($F(1, 131) = 28.55, p < .01$) regardless of the veteran principal status.

Follow-up analyses showed that the percentages of novice teachers in the low complexity schools (level 1) ($M = 29.28, SD = 13.36$) and level 2 ($M = 26.9, SD = 13.36$) were lower than the average ($M = 40.2, 17.67$) regardless of principal tenure. At the same time, the percentage of new classroom teachers among the most complex schools (level 4) led by new principals ($M = 53.30, SD = 14.38$) and veteran principals ($M = 55.04, SD = 14.4$) were comparable in magnitude but higher than the average for all schools (Appendix D, Tables D1–D2).

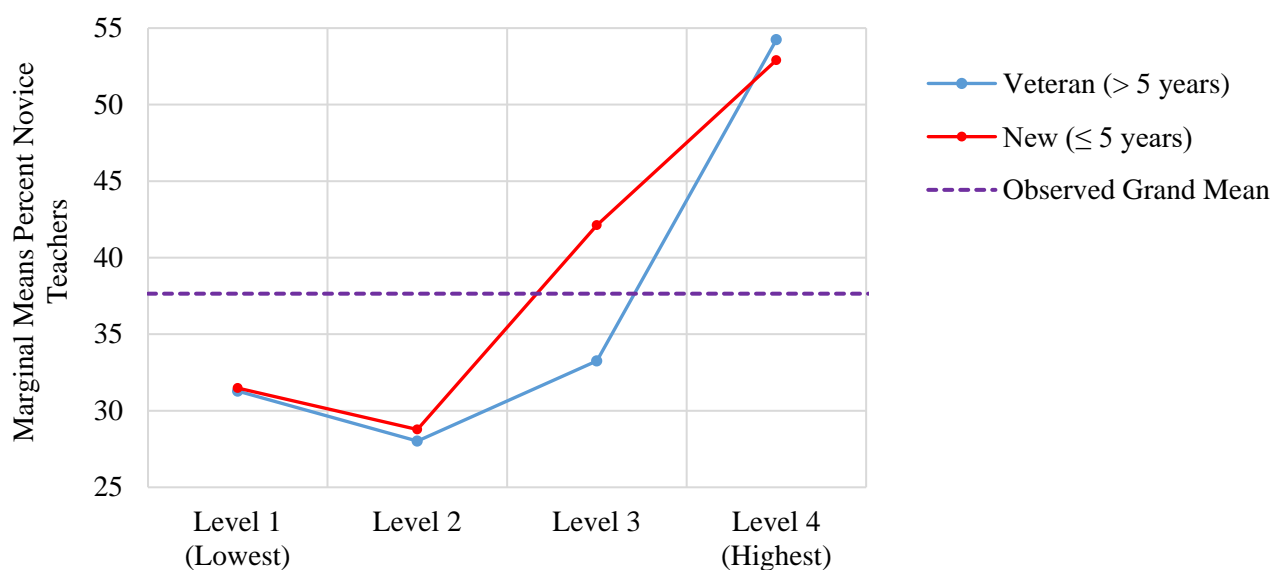


Figure 15. Estimated marginal means percent novice teachers by veteran principal status and school complexity in elementary schools.

Note. The dashed line represents the grand mean for the percent novice teachers

Academic Performance - Literacy. Figure 16 presents the plot of means of the percent meeting the 2018 EOL literacy benchmark by veteran principal status and school complexity. The main effect of veteran principal status on literacy performance was not statistically significant ($p > .05$); however, the interaction between having a veteran principal status and school complexity on literacy performance was statistically significant ($F(1, 132) = 8.89, p < .05$). Specifically, the passing rates in literacy for low complexity schools led by new principals ($M = 86.44, SD = 7.72$) were significantly higher relative to peer schools led by veteran principals ($M = 84.91, SD = 7.18$). The reverse was true for high complexity schools (level 4) led by veterans ($M = 57.2, SD = 7.45$) relative to peer schools led by new principals ($M = 55.30, SD = 7.82$).

In addition, a two-way analysis of variance yielded a main effect for school complexity on meeting the 2018 literacy benchmark ($F(1, 128) = 206.02, p < .05$). The passing rates for literacy were highest among the low complexity schools (level 1) ($M = 85.7; SD = 7.43$) followed by level 2 ($M = 76.67; SD = 7.38$) which were significantly higher than the passing rates for the high complexity schools (level 3) ($M = 65.14; SD = 8.35$) and level 4 ($M = 56.01; SD = 7.66$) (Appendix D, Tables D1–D2).

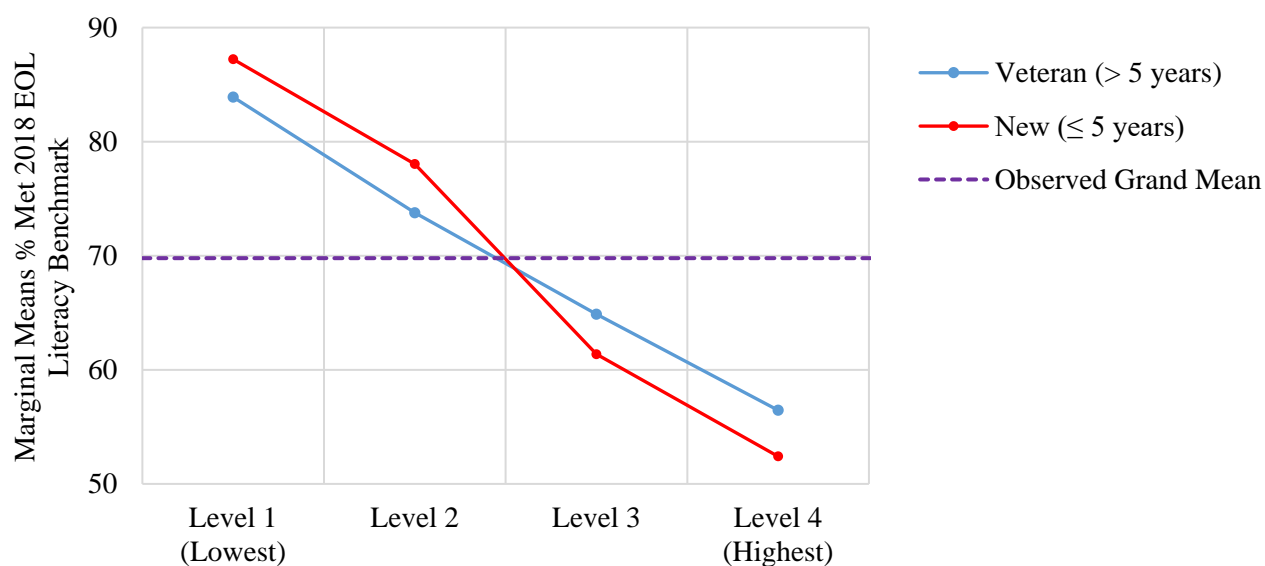


Figure 16. Estimated means percent met literacy benchmark by veteran principal status and school complexity in elementary schools

Note. The dashed line represents the grand mean for the percent met literacy benchmark

Academic Performance – Mathematics. Figure 17 illustrates the means for meeting the 2018 mathematics benchmark by school complexity levels and veteran principal status at the elementary school level. The main effect of veteran principal status on mathematics performance was not statistically significant ($p > .05$) nor was the interaction between having a veteran principal and school complexity. However, the main effect of school complexity was significant for percent meeting the 2018 EOL mathematics benchmark ($F(3, 124) = 101.36, p < .05$). Follow-up pairwise comparisons showed that the differences across the four levels of complexity were significant ($p < .05$). Specifically, low complexity schools (levels 1 and 2) performed well above the average performance levels regardless of principal tenure. Conversely, the rates of meeting the mathematics benchmarks were below the average among high complexity schools regardless of principal tenure (Appendix D, Tables D1–D2).

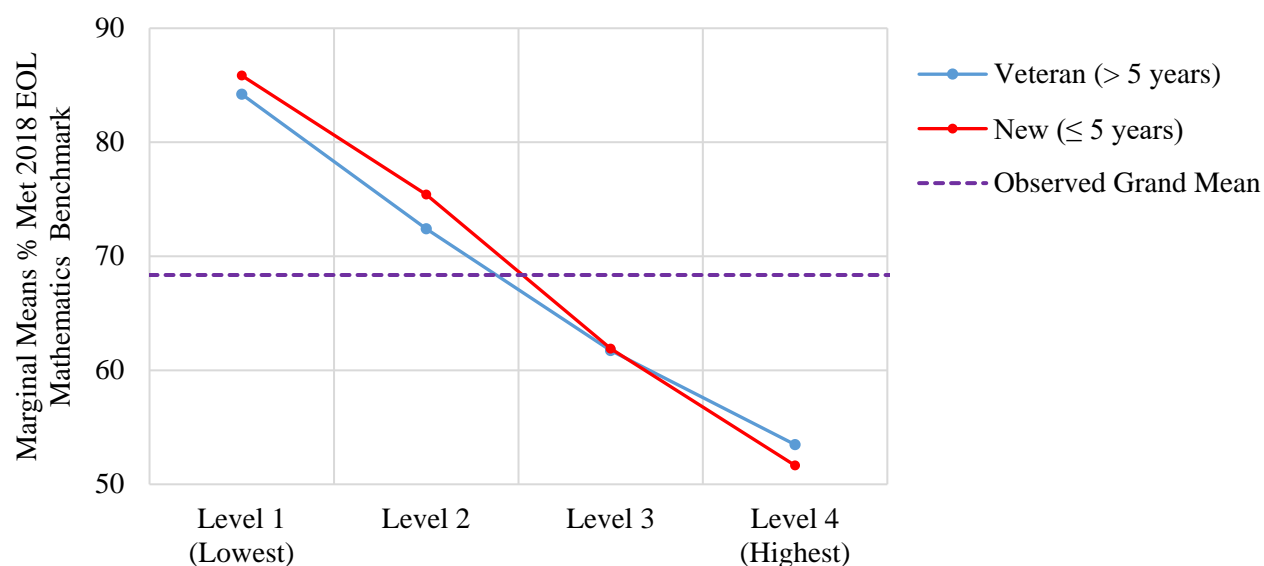


Figure 17. Estimated means percent met mathematics benchmark by veteran principal status and school complexity in elementary schools

Note. The dashed line represents the grand mean for the percent met mathematics benchmark

Middle School Level

School Climate. Figure 18 provides a graphical representation of the relationship between veteran principal status and school complexity on school climate scores. The main effect of veteran principal status on school climate and the interaction between veteran principal status and school complexity on school climate were not statistically significant ($p > .05$).

Notably, the relationship between school complexity and school climate was significant in middle schools ($F(1, 36) = 14.70, p < .01$) regardless of veteran principal status (Appendix D, Tables D3–D4).

The climate scores for the low complexity middle schools were markedly higher than the average middle school level scores, and significantly higher than the scores for high complexity middle schools. In addition, the mean climate scores in low complexity schools (levels 1 and 2) for schools led by new and veteran principals were almost similar (Figure 18). On the other hand, the mean climate scores among high complexity middle schools (levels 3 and 4) led by new principals were significantly higher (10 points) relative to peer schools led by veteran principals.

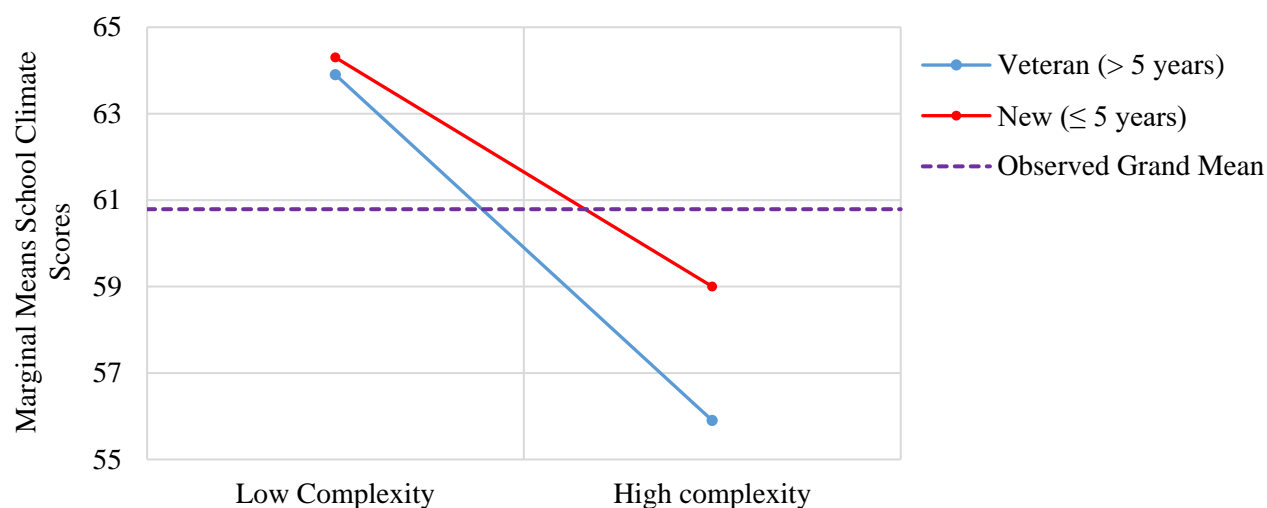


Figure 18. Estimated marginal means climate scores by veteran principal status and school complexity in middle schools

Note. The dashed line represents the grand mean for climate scores

Classroom Teacher Turnover. The main effect of veteran principal status on classroom teacher turnover was not statistically significant ($p > .05$), indicating that the difference in teacher turnover was not dependent primarily on having a new or veteran principal. However, the interaction between veteran principal status and school complexity on teacher turnover was statistically significant ($F(2, 36) = 7.71$, $p < .05$).

Figure 19 presents the percent of novice teachers by veteran principal status and school complexity. The turnover rate for classroom teachers in low complexity middle schools (levels 1 and 2) that were led by new principals was higher relative to peer schools led by veteran principals. Conversely, the turnover rate for classroom teachers in high complexity middle schools (levels 3 and 4) led by new principals was lower relative to the turnover rate in peer schools led by veteran principals. In addition, the effect of middle school complexity was significant in terms of the percentage of percent novice teachers ($F(1, 36) = 59.14$, $p < .01$). The rates of teacher turnover among high complexity middle schools were significantly higher than the overall average middle school rate as well as the rates among the low complexity schools (Appendix D, Tables D3–D4).

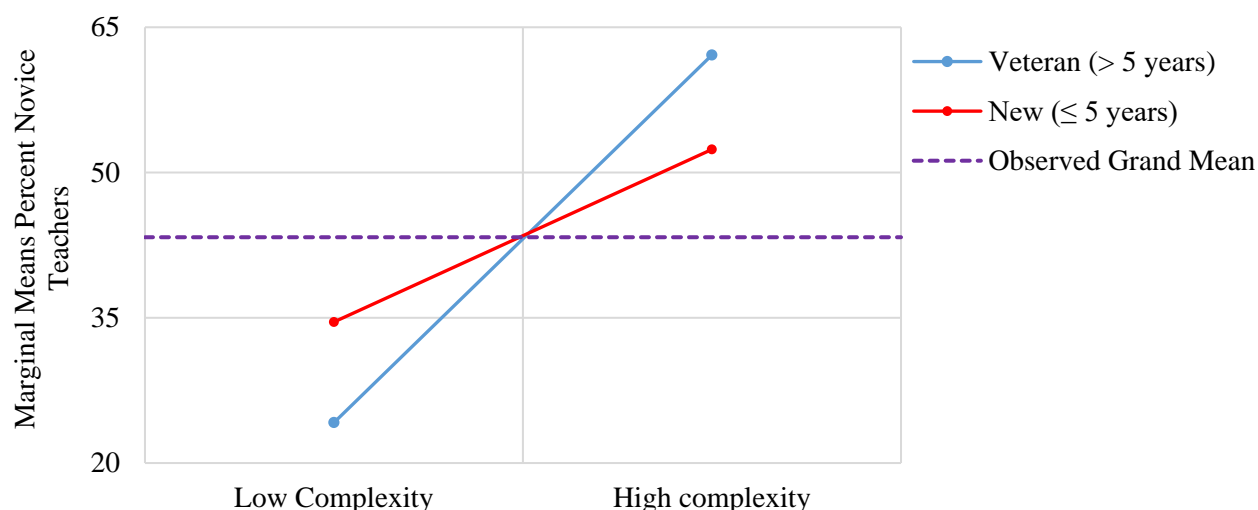


Figure 19. Estimated marginal means percent novice teachers by veteran principal status and school complexity in middle schools

Note. The dashed line represents the grand mean for the percent novice teachers

Academic Performance – Literacy and Mathematics. Although the main effect of veteran principal status on academic performance was not statistically significant ($p > .05$), the interactions between veteran principal status and school complexity on literacy and on mathematics were significant (literacy: $F(1, 36) = 7.97, p < .05$, and mathematics: $F(1, 36) = 6.28, p < .05$). In both instances, high complexity middle schools (levels 3 and 4) led by new principals outperformed peer schools led by veteran principals, while low complexity middle schools (levels 1 and 2) led by veteran principals outperformed peer schools led by new principals.

The effect of middle school complexity was significant in terms of percent students attaining the literacy ($F(1, 36) = 42.23, p < .01$) and mathematics benchmarks ($F(1, 36) = 42.23, p < .01$). Specifically, the percent of students meeting the literacy and mathematics benchmark among high complexity middle schools were significantly lower than the overall average middle school rates, and the rates for low complexity schools (Appendix D, Tables D3–D4).

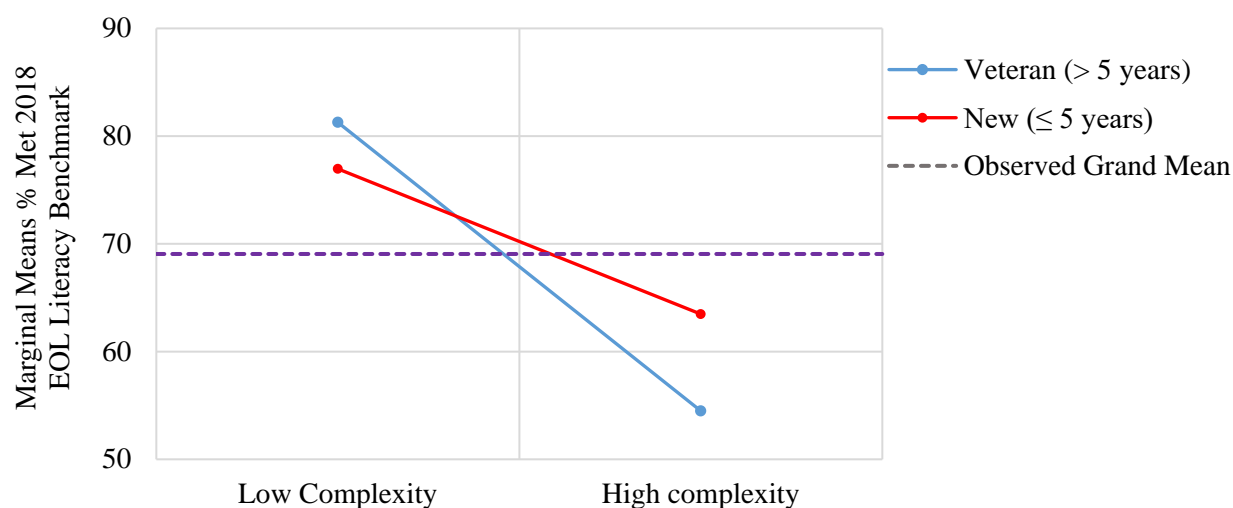


Figure 20. Estimated means percent met literacy benchmark by veteran principal status and school complexity in middle schools

Note. The dashed line represents the grand mean for the percent met literacy benchmark

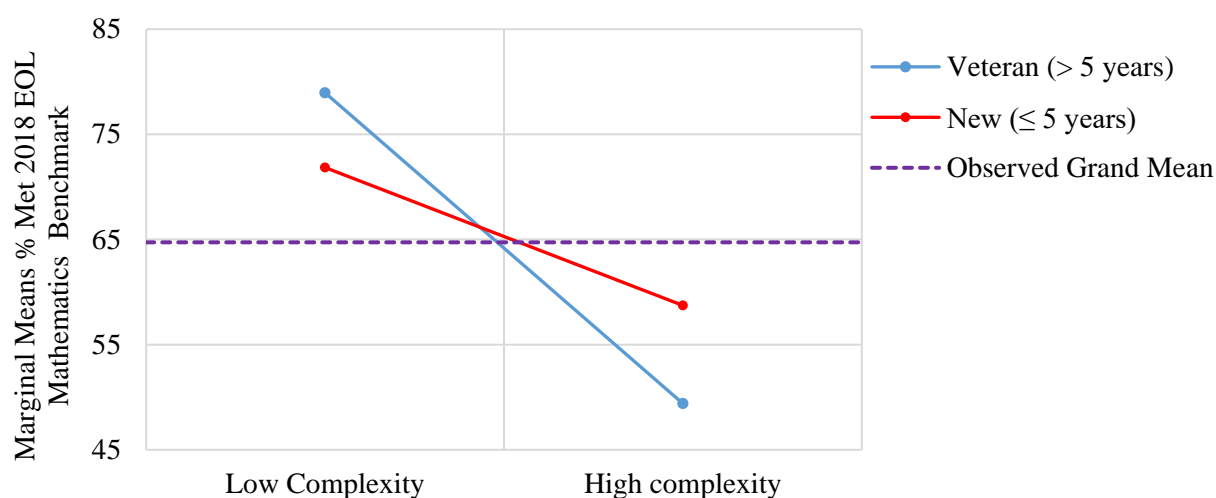


Figure 21. Estimated percent that met mathematics benchmark, by veteran principal status and school complexity in middle schools

Note. The dashed line represents the grand mean for the percent met mathematics benchmark

High School Level

At the high school level, veteran principal status was not related to any of the school level variables examined—school climate, classroom teacher turnover, or academic performance in literacy and mathematics. In addition, with only 26 high schools, the high school level samples were not large enough to reliably examine the interaction of veteran principal status and school complexity. Summary statistics

and tests of Between-Subjects Effects are presented in Appendix D, Tables D5–D6. Findings related to school complexity are described below.

School Climate. There was no difference in school climate scores by school complexity ($p < .05$) at the high school level (Appendix D, Table D6).

Classroom Teacher Turnover. The classroom turnover increased as the school complexity increased. Specifically, the high complexity high schools (levels 3 and 4) had significantly higher percentages of novice teachers than low complexity high schools (levels 1 and 2) ($F(1, 24) = 7.20, p < .05$) regardless of whether they had a new or veteran principal (Appendix D, Table D6).

Academic Performance – Literacy and Mathematics. Low complexity high schools (levels 1 and 2) significantly outperformed high complexity high schools (levels 3 and 4) in the percent of students meeting the literacy ($F(1, 24) = 46.36, p < .05$) or mathematics ($F(1, 24) = 20.65, p < .05$) benchmarks, regardless of veteran principal status (Appendix D, Table D6).

Summary

The purpose of this study was to explore principal turnover and the factors associated with it in MCPS. In general, the staff in principal roles in MCPS have the same level of educational qualification for the job, even with variation in age, gender, and levels of experience across school levels. About half of principals have been in their positions for five years or less; still, more than two thirds have been at the same school since FY 2015.

The change in school leadership was most evident among middle schools. Seven of the 40 middle schools (18%) had four or more principals since FY 2010, compared to five of the 134 elementary schools (3%), and four of the 26 high schools (15%). The findings also revealed that high poverty and high complexity elementary schools are overrepresented among the schools with three or more principals since FY 2010.

Across years, principal attrition ranged from 13% in FY 2015 to 11% in FY 2018. School climate scores and performance in mathematics and literacy was lower whereas and classroom teacher turnover was higher in schools with more than three principals since FY 2010.

Overall, veteran principal status (new or veteran) was not associated with the school level variables of school climate, percent of new teachers, or academic performance in literacy and mathematics with a few exceptions. School complexity explained most of the variation in school climate scores, percent novice teachers, and school academic performance at the elementary, middle, and high levels. However, having a new principal was associated with higher academic performance in literacy among low complexity elementary schools. Also, high complexity middle schools led by new principals outperformed peer schools led by veteran principals in literacy and mathematics, as well as low complexity middle schools (levels 1 and 2) led by veteran principals.

Discussion

The findings from this study corroborated reports by other researchers—that low-income students are likely to experience the effects of principal churn at greater rates than peers from less impacted schools are (School Leaders Network, 2014, Levin and Bradley, 2019). While principal attrition rates in MCPS since FY 2010 are within the national average of 12%, the findings also align with studies that found that high poverty schools and high complexity schools (i.e., schools enrolling disproportionately higher numbers of students receiving special services, as well as higher proportions of Black and Hispanic students) have higher principal turnover rates. Also found in this study is the compounding problem that high complexity schools often struggle with retaining experienced teachers—in this study the percent of new teachers in high complexity schools was significantly higher than the MCPS average.

The findings in this study do not support the premise or provide direct evidence that poor school climate, high teacher turnover, or low student academic achievement are more evident in school with new principals or as a direct result of principal turnover. Actually, this study found that school climate scores, student performance, and percent of novice classroom teachers were related more to school complexity than having a new or veteran principal. These findings are in line with the explanation by Levin and Bradley (2019)—that the root problem of low climate scores, teacher turnover, and low student performance might be the school characteristics. These researchers also pointed out that, in most cases, the school characteristics are concurrent with indicators of student advantage or disadvantage. The challenge becomes how to create optimal learning environments for all students and positive school climate for teachers in the high complexity schools.

That some new principals did very well in low complexity schools relative to veterans suggest that many positive changes that arise from principal turnover many go unnoticed or unreported. Specifically, this study revealed that low complexity schools led by new principals outperformed their peer schools led by veteran principals on literacy and mathematics (especially in elementary and middle schools). Refocusing attention from principal turnover per se to include a concerted examination of the school settings and principal behaviors is important. A focus of principal behaviors was emphasized by a recent study. The study showed there is great value in investing in school leadership capacities because their findings showed direct evidence of relationships between principal behaviors, student achievement, teacher wellbeing, teacher instructional practices, and school organizational health (Liebowitz and Porter, 2019). Enhancing leadership capacity is critical particularly for high complexity low performing school in the light of research that show that: 1) it takes a new principal up to three years to regain positive momentum in mathematics and English language arts performance; and 2) principal's account for about 25 percent of a school's total influence on student academic performance (Fuller, 2007; SLN, 2014). Lastly, this study points to the need to: 1) examine what schools with low academic achievement and low principal turnover have in common; and 2) assess needs of schools with veteran principals, which also continue to have high teacher turnover, low student performance, and poor school climate.

Acknowledgements

The authors would like to thank Dr. Shahpar Modarresi, supervisor, Program evaluation unit (PEU), for her guidance through the planning of this study and review of the report; staff from the Employee and Retiree Service Center (ERSC) (Mr. Krishnanda Tallur, director, and Mrs. Sonal Sathe, data support specialist) for processing and availing a variety of data needed to complete this study; Ms. Maria Allendes, office assistant, PEU, for technical support; and Ms. Julie Wade, evaluation specialist, PEU, for her very insightful and helpful peer review of the report.

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Appendix A

Table A1. List of Elementary Schools by Poverty and Complexity Levels

School Name	Pov.	Complex.	School Name	Pov.	Complex.	School Name	Pov.	Complex.
Arcola	3	4	Fox Chapel	2	3	Rock Creek Valley	2	3
Ashburton	1	1	Gaithersburg	3	4	Rock View	2	3
Bannockburn	1	1	Galway	3	4	Ronald A. McNair	2	2
Beall	2	2	Garrett Park	1	2	Rolling Terrace	3	4
Bel Pre	3	4	Georgian Forest	3	4	Roscoe R. Nix	3	4
Bells Mill	1	1	Germantown	2	3	Rosemary Hills	2	2
Belmont	1	1	Glellan	2	3	Rosemont	2	4
Bethesda	1	1	Glen Haven	2	3	S. Christa McAuliffe	2	3
Beverly Farms	1	1	Goshen	2	3	Sargent Shriver	3	4
Bradley Hills	1	1	Great Seneca Creek	2	3	Sequoyah	2	3
Brooke Grove	2	2	Greencastle	3	3	Seven Locks	1	1
Brookhaven	3	4	Greenwood	1	1	Sherwood	1	2
Brown Station	3	3	Harmony Hills	3	4	Sligo Creek	1	1
Burning Tree	1	1	Highland	3	4	Somerset	1	1
Burnt Mills	3	3	Highland View	2	3	South Lake	3	4
Burtonsville	2	3	Jackson Road	3	4	Spark M. Matsunaga	2	2
Candlewood	2	2	JoAnn Leleck	3	4	Stedwick	2	4
Cannon Road	3	3	Jones Lane	2	2	Stone Mill	1	1
Capt. James Daly	3	4	Judith A. Resnik	2	3	Stonegate	2	2
Carderock Springs	1	1	Kemp Mill	3	4	Strathmore	3	4
Cashell	2	2	Kensington Parkwood	1	1	Strawberry Knoll	2	3
Cedar Grove	1	1	Lake Seneca	2	3	Summit Hall	3	4
Chevy Chase	2	1	Lakewood	1	1	Takoma Park	2	3
Clarksburg	1	2	Laytonsville	1	2	Thurgood Marshall	2	2
Clearspring	2	2	Little Bennett	1	2	Travilah	1	1
Clopper Mill	3	4	Lois P. Rockwell	1	2	Twinbrook	3	4
Cloverly	2	2	Lucy V. Barnsley	2	2	Viers Mill	3	4
Cold Spring	1	1	Luxmanor	1	2	Washington Grove	3	4
College Gardens	1	2	Maryvale	2	3	Waters Landing	2	3
Cresthaven	3	4	Meadow Hall	2	3	Watkins Mill	3	4
Damascus	2	2	Mill Creek Towne	2	3	Wayside	1	1
Darnestown	1	1	Monocacy	1	1	Weller Road	3	4
Diamond	1	2	Montgomery Knolls	3	4	Westbrook	1	1
Dr. Charles Drew	2	3	New Hampshire Estates	3	4	Westover	2	2
Dr. Sally K. Ride	2	3	North Chevy Chase	2	1	Wheaton Woods	3	4
DuFief	1	2	Oak View	3	4	Whetstone	3	4
East Silver Spring	2	3	Oakland Terrace	2	2	William B. Gibbs, Jr.	2	2
Fairland	2	3	Olney	1	2	William Tyler Page	2	3
Fallsmead	1	1	Pine Crest	2	3	Wilson Wims	1	1
Farmland	1	1	Piney Branch	2	3	Wood Acres	1	1
Fields Road	2	3	Poolesville	1	1	Woodfield	2	1
Flora M. Singer	2	3	Potomac	1	1	Woodlin	2	2
Flower Hill	2	4	Rachel Carson	2	2	Wyngate	1	1
Flower Valley	2	2	Ritchie Park	1	2			
Forest Knolls	2	3	Rock Creek Forest	2	2			

Note. Data as of 2018

Pov. = Poverty Group. Complex. = School Complexity Quartile. % FARMS average in elementary is 39.3.

Poverty Group 1 (Low Poor) = % FARMS is lower than 20 points below the school level FARMS average.

Poverty Group 2 (Medium Poor) = % FARMS is -+20 points from the school level FARMS average.

Poverty Group 3 (High Poor) = % FARMS is greater than 20 points above the school level FARMS average.

Table A2. List of Middle and High Schools by Poverty Group and Quartile (School Complexity Distribution)

MIDDLE SCHOOLS			HIGH SCHOOLS		
School Name	Poverty Level.	Complexity.	School Name	Poverty Level.	Complexity.
A. Mario Loiederman	3	4	Albert Einstein	2	3
Argyle	3	4	Bethesda-Chevy Chase	2	2
Benjamin Banneker	2	4	Clarksburg	2	2
Briggs Chaney	2	3	Col. Zadok Magruder	2	3
Cabin John	1	1	Damascus	2	1
Col. E. Brooke Lee	3	4	Gaithersburg	2	4
Earle B. Wood	2	3	James Hubert Blake	2	3
Eastern	2	3	John F. Kennedy	3	4
Forest Oak	3	4	Montgomery Blair	2	3
Francis Scott Key	3	4	Northwest	2	2
Gaithersburg	2	4	Northwood	3	4
Hallie Wells	2	1	Paint Branch	2	3
Herbert Hoover	1	1	Poolesville	2	1
John Poole	1	1	Quince Orchard	2	2
John T. Baker	2	2	Richard Montgomery	2	2
Julius West	2	2	Rockville	2	2
Kingsview	2	2	Seneca Valley	2	3
Lakelands Park	2	2	Sherwood	2	2
Martin Luther King	2	3	Springbrook	3	3
Montgomery Village	3	4	Thomas Edison HS of Technology	3	4
Neelsville	3	4	Thomas S. Wootton	1	1
Newport Mill	2	3	Walt Whitman	1	1
North Bethesda	1	1	Walter Johnson	2	1
Parkland	3	3	Watkins Mill	3	4
Redland	2	3	Wheaton	3	4
Ridgeview	2	2	Winston Churchill	1	1
Robert Frost	1	1			
Roberto Clemente	2	2			
Rocky Hill	2	2			
Rosa M. Parks	1	1			
Shady Grove	2	3			
Silver Creek	2	2			
Silver Spring International	2	3			
Sligo	2	3			
Takoma Park	2	2			
Thomas W. Pyle	1	1			
Tilden	2	1			
Westland	1	1			
White Oak	3	4			
William H. Farquhar	2	2			

Note. Data as of 2018

Poverty level. = Poverty Group. Complexity. = School Complexity Quartile.

% FARMS average in middle schools is 32.7 and in high schools 27.0.

Poverty Group 1 (Low Poor) = % FARMS is lower than 20 points below the school level FARMS average.

Poverty Group 2 (Medium Poor) = % FARMS is +20 points from the school level FARMS average.

Poverty Group 3 (High Poor) = % FARMS is greater than 20 points above the school level FARMS average.

Table A3. Descriptive Analysis of School-Level Characteristics as of 2018 by Quartile (School Complexity Distribution) and by School Level

	Quartile 1			Quartile 2			Quartile 3			Quartile 4		
	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median
<i>Elementary Schools</i>												
% Ever FARMS	1.4	22.6	9.5	13.3	37.7	26.4	33.4	70.0	56.4	61.9	90.2	79.6
% Black or African American & Hispanic/Latino	7.6	34.0	18.1	21.7	59.7	37.9	46.1	86.7	66.7	72.7	96.0	84.1
% SPED	4.3	21.5	8.8	6.0	28.1	14.1	4.5	22.7	12.1	6.3	22.1	11.1
% ESOL	2.8	23.0	8.5	7.7	26.4	14.3	11.1	37.2	25.4	31.0	73.7	48.4
<i>Middle Schools</i>												
% Ever FARMS	3.0	28.6	13.2	27.6	50.4	35.5	52.8	71.3	59.6	62.8	84.6	76.9
% Black or African American & Hispanic/Latino	13.2	33.3	20.3	37.2	53.9	39.6	57.3	73.8	62.9	70.4	85.9	81.1
% SPED	6.0	15.5	9.9	8.0	15.7	9.7	7.4	20.9	12.5	7.0	18.4	10.5
% ESOL	1.3	11.3	3.3	2.0	7.8	5.6	6.1	18.1	10.7	5.2	19.8	16.8
<i>High Schools</i>												
% Ever FARMS	4.7	29.0	13.3	20.8	53.6	41.4	53.5	69.9	63.6	70.5	80.6	75.6
% Black or African American & Hispanic/Latino	12.8	30.2	15.5	31.8	56.8	41.7	56.7	76.9	67.2	74.0	86.7	79.0
% SPED	5.4	12.6	10.0	7.0	14.6	9.4	6.8	13.7	10.2	8.8	26.8	12.8
% ESOL	0.0	5.7	1.5	2.4	12.7	8.9	3.6	18.0	13.3	21.1	25.8	23.8

Appendix B

Table B1. Relationship Between Principal Gender and Levels of School Complexity by School Level

Level	Test	Test Statistic	df	p-value
Elementary	Chi-square	7.04	3	0.070
Middle	Chi-square	5.194	3	0.158
High school	Chi-square	4.133	3	0.247

Table B2. Relationship Between Principal Gender and Being at a Low, Medium, or High Poverty School by School Level

Level	Test	Test Statistic	df	p-value
Elementary	Chi-square	3.59	2	0.16
Middle	Chi-square	1.013	2	0.603
High school	Chi-square	0.392	2	0.822

Table B3. Relationship Between Principals Years of Experience in MCPS and Being at a Low, Medium or High Poverty School by School Level

Level	Test	Test Statistic	df	p-value
Elementary	Chi-square	5.47	2	0.065
Middle	Chi-square	1.208	2	0.547
High School	Chi-square	2.473	2	0.290

Appendix C

Table C1. Relationship Between Schools' Principal Turnover and Levels of School Poverty

	Test	Test Statistic	df	p-value
<i>Elementary</i>				
Schools' levels of poverty as of 2018	Chi-Square Test	15.26	2	.00
Schools' levels of poverty as of 2010	Fisher's Exact Test	--	--	.02
<i>Middle</i>				
Schools' levels of poverty as of 2018	Fisher's Exact Test	--	--	.09
Schools' levels of poverty as of 2010	Fisher's Exact Test	--	--	.42
<i>High</i>				
Schools' levels of poverty as of 2018	Fisher's Exact Test	--	--	.40
Schools' levels of poverty as of 2010	Fisher's Exact Test	--	--	.29

Table C2. Relationship Between Schools' Principal Turnover and Levels of School Complexity

	Test	Test Statistic	df	p-value
<i>Elementary</i>				
Schools' levels of complexity as of 2018	Chi-Square Test	--	--	.06
Schools' levels of complexity as of 2010	Chi-Square Test	.92	3	.82
<i>Middle</i>				
Schools' levels of complexity as of 2018	Fisher's Exact Test	--	--	.11
Schools' levels of complexity as of 2010	Fisher's Exact Test	--	--	.01
<i>High</i>				
Schools' levels of complexity as of 2018	Fisher's Exact Test	--	--	.45
Schools' levels of complexity as of 2010	Fisher's Exact Test	--	--	.25

Table C3. Analysis of Average Percentage Differences Between Schools' Principal Turnover and 2018 End-Of-Year Evidence of Learning (EOL) Measures in Literacy and Math

	t	df	Sig.	Mean Diff.	Std. Error Diff.	95% Conf. Int. of the Difference	
						Lower	Upper
<i>Literacy</i>							
Elementary	3.18	132	.00	9.55	3.01	3.60	15.50
Middle	.35	38	.73	1.35	3.85	-6.50	9.15
High	1.62	23	.12	7.58	4.70	-2.13	17.30
<i>Math</i>							
Elementary	2.69	132	.01	8.42	3.13	2.23	14.61
Middle	.26	38	.80	1.18	4.59	-8.10	10.47
High	1.12	23	.28	7.02	6.28	-5.96	20.01

Note. Equal variances are assumed.

Table C4. Analysis of Average Percentage Differences Between Schools' Principal Turnover and Schools' Climate Satisfaction Score

	t	df	Sig.	Mean Diff.	Std. Error Diff.	95% Conf. Int. of the Difference	
						Lower	Upper
Elementary	1.84	131	.07	2.68	1.45	-.20	5.56
Middle	1.27	38	.21	2.37	1.86	-1.40	6.13
High	-1.06	24	.30	2.45	2.31	-2.31	7.22

Note. Equal variances are assumed.

Appendix D**Table D1. Descriptive Statistics for School Level Variables by School Complexity - Elementary School Level**

School factor	Two Level Complex	New principal in the last 5 years	Mean	Std. Deviation	N
School Climate Score	Level 1 and 2 (low)	Veteran (>5 years)	66.22	6.39	37
		New (1–5 years)	64.49	6.03	28
		Total	65.48	6.25	65
	Level 3 and 4 (high)	Veteran (>5 years)	61.08	5.25	25
		New (1–5 years)	60.73	6.83	42
		Total	60.86	6.24	67
Percent Novice Teachers	Level 1 and 2 (low)	Veteran (>5 years)	29.43	14.04	37
		New (1–5 years)	30.32	15.15	28
		Total	29.82	15.15	65
	Level 3 and 4 (high)	Veteran (>5 years)	43.33	17.21	25
		New (1–5 years)	47.52	18.61	42
		Total	45.95	18.08	67
% met Math Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	77.51	8.83	37
		New (1– years)	81.38	9.27	28
		Total	79.18	9.16	65
	Level 3 and 4 (high)	Veteran (>5 years)	57.77	10.21	25
		New (1–5 years)	56.77	9.36	42
		Total	57.14	9.62	67
% met Literacy Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	78.15	8.71	37
		New (1–5 years)	83.29	8.97	28
		Total	80.36	9.12	65
	Level 3 and 4 (high)	Veteran (>5 years)	60.83	9.08	25
		New (1–5 years)	56.89	7.82	42
		Total	58.36	8.46	67

Table D2. Tests of Between-Subjects Effects: School Level Variables by School Complexity - Elementary School Level

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	School climate score	753.044 ^b	3	251.015	6.399	0.000	0.130
	Percent novice teacher	8879.857 ^c	3	2959.952	10.949	0.000	0.204
	% met literacy benchmark in 2018	16637.563 ^d	3	5545.854	75.653	0.000	0.639
	% met math benchmark in 2018	16270.147 ^e	3	5423.382	61.873	0.000	0.592
Intercept	School climate score	503884.733	1	503884.733	12845.688	0.000	0.990
	Percent novice teacher	179220.013	1	179220.013	662.972	0.000	0.838
	% met literacy benchmark in 2018	615770.447	1	615770.447	8399.983	0.000	0.985
	% met math benchmark in 2018	590775.644	1	590775.644	6739.874	0.000	0.981
School Complexity		626.095	1	626.095	15.961	0.000	0.111
	Percent novice teacher	7638.051	1	7638.051	28.255	0.000	0.181
	% met literacy benchmark in 2018	15102.032	1	15102.032	206.013	0.000	0.617
	% met math benchmark in 2018	15541.369	1	15541.369	177.304	0.000	0.581
New Principal	School climate score	34.607	1	34.607	0.882	0.349	0.007
	Percent novice teacher	203.931	1	203.931	0.754	0.387	0.006
	% met literacy benchmark in 2018	11.199	1	11.199	0.153	0.697	0.001
	% met math benchmark in 2018	64.922	1	64.922	0.741	0.391	0.006
School Complexity * New Principal	School climate score	15.041	1	15.041	0.383	0.537	0.003
	Percent novice teacher	85.660	1	85.660	0.317	0.574	0.002
	% met literacy benchmark in 2018	651.545	1	651.545	8.888	0.003	0.065
	% met math benchmark in 2018	186.760	1	186.760	2.131	0.147	0.016
Error	School climate score	5020.926	128	39.226			
	Percent novice teacher	34602.011	128	270.328			
	% met literacy benchmark in 2018	9383.188	128	73.306			
	% met math benchmark in 2018	11219.687	128	87.654			
Total	School climate score	531893.867	132				
	Percent novice teacher	234159.448	132				
	% met literacy benchmark in 2018	658002.366	132				
	% met math benchmark in 2018	637735.360	132				
Corrected Total	School climate score	5773.969	131				
	Percent novice teacher	43481.869	131				
	% met literacy benchmark in 2018	26020.750	131				
	% met math benchmark in 2018	27489.835	131				

Table D3. Descriptive Statistics for School Level Variables by School Complexity- Middle School Level

	Two Level Complexity	New principal in the last 5 Years	Mean	Std. Deviation	N
School Climate Score	Level 1 and 2 (low)	Veteran (>5 years)	63.87	4.49	10
		New (1–5 years)	64.31	5.23	10
		Total	64.09	4.75	20
	Level 3 and 4 (high)	Veteran (>5 years)	55.93	3.81	5
		New (1–5 years)	59.05	5.49	15
		Total	58.27	5.22	20
Percent Novice Teachers	Level 1 and 2 (low)	Veteran (>5 years)	24.18	11.61	10
		New (1–5 years)	34.57	10.79	10
		Total	29.38	12.14	20
	Level 3 and 4 (high)	Veteran (>5 years)	62.14	7.13	5
		New (1–5 years)	52.39	10.66	15
		Total	54.83	10.64	20
% met Math Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	78.95	8.26	10
		New (1– years)	71.84	10.24	10
		Total	75.39	9.76	20
	Level 3 and 4 (high)	Veteran (>5 years)	49.40	9.40	5
		New (1–5 years)	58.73	10.04	15
		Total	56.40	10.49	20
% met Literacy Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	81.28	6.28	10
		New (1–5 years)	76.96	7.11	10
		Total	79.12	6.90	20
	Level 3 and 4 (high)	Veteran (>5 years)	54.49	5.50	5
		New (1–5 years)	63.48	7.47	15
		Total	61.23	7.97	20

Table D4. Tests of Between-Subjects Effects School Level Variables by School Complexity - Middle School Level

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	School climate score	376.216 ^b	3	125.405	4.97	0.01	0.293
	Percent novice teacher	7373.254 ^c	3	2457.751	21.81	0.00	0.645
	% met literacy benchmark in 2018	3597.016 ^d	3	1199.005	25.19	0.00	0.677
	% met math benchmark in 2018	4186.951 ^e	3	1395.650	15.12	0.00	0.558
Intercept	School climate score	126699.389	1	126699.389	5020.22	0.00	0.993
	Percent novice teacher	64340.206	1	64340.206	570.93	0.00	0.941
	% met literacy benchmark in 2018	163494.549	1	163494.549	3434.86	0.00	0.990
	% met math benchmark in 2018	143656.190	1	143656.190	1556.48	0.00	0.977
School Complexity	School climate score	373.356	1	373.356	14.79	0.00	0.291
	Percent novice teacher	6665.609	1	6665.609	59.15	0.00	0.622
	% met literacy benchmark in 2018	3475.863	1	3475.863	73.03	0.00	0.670
	% met math benchmark in 2018	3898.524	1	3898.524	42.24	0.00	0.540
New Principal	School climate score	27.262	1	27.262	1.08	0.31	0.029
	Percent novice teacher	0.896	1	0.896	0.01	0.93	0.000
	% met literacy benchmark in 2018	46.648	1	46.648	0.98	0.33	0.027
	% met math benchmark in 2018	10.580	1	10.580	0.12	0.74	0.003
School Complexity * New Principal	School climate score	15.300	1	15.300	0.61	0.44	0.017
	Percent novice teacher	869.110	1	869.110	7.71	0.01	0.176
	% met literacy benchmark in 2018	379.520	1	379.520	7.97	0.01	0.181
	% met math benchmark in 2018	579.346	1	579.346	6.28	0.02	0.148
Error	School climate score	908.561	36	25.238			
	Percent novice teacher	4056.997	36	112.694			
	% met literacy benchmark in 2018	1713.548	36	47.599			
	% met math benchmark in 2018	3322.646	36	92.296			
Total	School climate score	151003.112	40				
	Percent novice teacher	82331.192	40				
	% met literacy benchmark in 2018	202310.646	40				
	% met math benchmark in 2018	181203.746	40				
Corrected Total	School climate score	1284.777	39				
	Percent novice teacher	11430.251	39				
	% met literacy benchmark in 2018	5310.563	39				
	% met math benchmark in 2018	7509.597	39				

Table D5. Descriptive Statistics for School Level Variables by School Complexity - High School Level

	Two Level Complex	New principal in the last 5 years	Mean	Std. Deviation	N
School Climate Score	Level 1 and 2 (low)	Veteran (>5 years)	62.20	2.46	3
		New (1–5 years)	58.37	4.98	10
		Total	59.26	4.74	13
	Level 3 and 4 (high)	Veteran (>5 years)	59.55	5.00	7
		New (1–5 years)	58.57	2.77	5
		Total	59.14	4.08	12
Percent Novice Teacher	Level 1 and 2 (low)	Veteran (>5 years)	26.23	12.67	3
		New (1–5 years)	25.02	9.45	10
		Total	25.30	9.69	13
	Level 3 and 4 (high)	Veteran (>5 years)	33.00	6.70	7
		New (1–5 years)	39.99	9.79	5
		Total	35.91	8.51	12
% met Math Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	75.83	13.01	3
		New (1–5 years)	75.63	8.87	10
		Total	75.67	9.34	13
	Level 3 and 4 (high)	Veteran (>5 years)	58.20	7.65	7
		New (1–5 years)	59.95	3.75	5
		Total	58.93	6.15	12
% met Literacy Benchmark in 2018	Level 1 and 2 (low)	Veteran (>5 years)	87.45	8.74	3
		New (1–5 years)	87.93	4.60	10
		Total	87.82	5.35	13
	Level 3 and 4 (high)	Veteran (>5 years)	73.98	4.20	7
		New (1–5 years)	71.69	4.07	5
		Total	73.02	4.13	12

Table D6. Tests of Between-Subjects Effects for School Level Variables by School Complexity-High School Level

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	School climate score	36.769 ^b	3	12.256	0.62	0.61	0.081
	Percent novice teacher	849.387 ^c	3	283.129	3.35	0.04	0.323
	% met literacy benchmark in 2018	1381.589 ^d	3	460.530	18.77	0.00	0.728
	% met math benchmark in 2018	1758.439 ^e	3	586.146	8.47	0.00	0.548
Intercept	School climate score	73401.646	1	73401.646	3702.93	0.00	0.994
	Percent novice teacher	19886.585	1	19886.585	235.00	0.00	0.918
	% met literacy benchmark in 2018	132788.765	1	132788.765	5411.24	0.00	0.996
	% met math benchmark in 2018	93649.005	1	93649.005	1353.37	0.00	0.985
School Complexity	School climate score	7.782	1	7.782	0.39	0.54	0.018
	Percent novice teacher	609.414	1	609.414	7.20	0.01	0.255
	% met literacy benchmark in 2018	1137.519	1	1137.519	46.36	0.00	0.688
	% met math benchmark in 2018	1428.930	1	1428.930	20.65	0.00	0.496
New Principal	School climate score	29.825	1	29.825	1.51	0.23	0.067
	Percent novice teacher	43.123	1	43.123	0.51	0.48	0.024
	% met literacy benchmark in 2018	4.233	1	4.233	0.17	0.68	0.008
	% met math benchmark in 2018	3.104	1	3.104	0.05	0.83	0.002
School Complexity * New Principal	School climate score	10.485	1	10.485	0.53	0.48	0.025
	Percent novice teacher	86.657	1	86.657	1.02	0.32	0.046
	% met literacy benchmark in 2018	9.845	1	9.845	0.40	0.532	0.019
	% met math benchmark in 2018	4.926	1	4.926	0.07	0.79	0.003
Error	School climate score	416.275	21	19.823			
	Percent novice teacher	1777.069	21	84.622			
	% met literacy benchmark in 2018	515.328	21	24.539			
	% met math benchmark in 2018	1453.133	21	69.197			
Total	School climate score	88069.470	25				
	Percent novice teacher	25721.125	25				
	% met literacy benchmark in 2018	164775.144	25				
	% met math benchmark in 2018	117581.048	25				
Corrected Total	School climate score	453.043	24				
	Percent novice teacher	2626.455	24				
	% met literacy benchmark in 2018	1896.917	24				
	% met math benchmark in 2018	3211.573	24				